JCD
vol. 27 issue 4
Journal of Cosmetic Dentistry

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Journal of Cosmetic Dentistry • Winter 2012 • Volume 27 • Number 4

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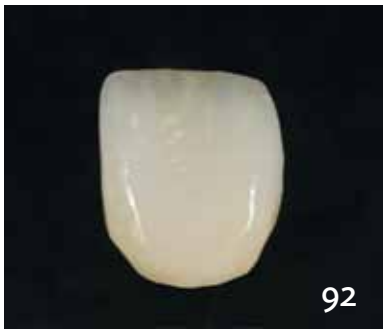

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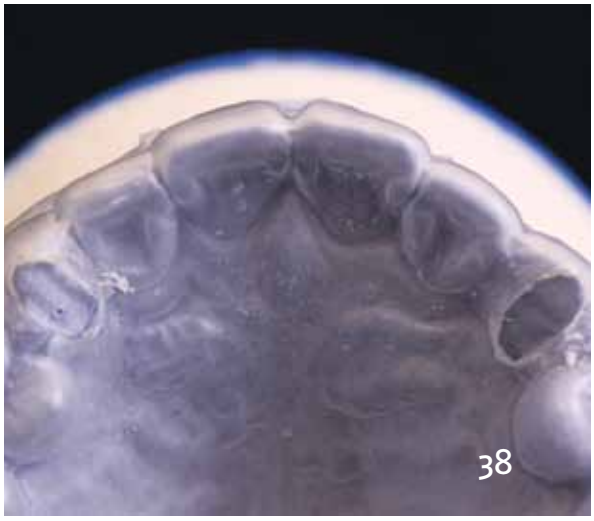

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The *Journal of Cosmetic Dentistry*, ISSN # 1532-8910, USPS# 10452, published four times a year, January, April, July, and October. $200 per year (U.S. & Canada) or $240 per year (All other countries), single issues available upon request, by the American Academy of Cosmetic Dentistry®, 402 West Wilson Street, Madison, WI 53703. 800.543.9220 OR 608.222.8583. Periodicals postage paid in Madison, WI, and additional offices.

POSTMASTER: send address changes to:
Journal of Cosmetic Dentistry
American Academy of Cosmetic Dentistry
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The Principles of Study Clubs

Michael Cohen, DDS, MSD

Dr. Cohen is a visiting assistant clinical professor in the Department of Periodontics at the University of Washington. The founder of Seattle Study Club, he maintains a private practice limited to periodontics and implants in the Seattle, Washington, area.

Disclosure: The author did not report any financial compensation for this editorial.

Study clubs are traditionally thought of as a group of individuals who meet on a regular basis to better their understanding of the art and science of dentistry. This certainly describes a very basic level of what study clubs do, but they can be and in many cases are, much more than this. In my view, effective study clubs have three major principles. The first is the philosophy that neither ideal learning nor ideal dentistry can be attained by a random exposure to various techniques and treatment modalities, even if those techniques, taken individually, represent "state-of-the-art" treatment. Rather, the highest and most beneficial knowledge and treatment results from total case management—an appreciation of the "big picture" and a true understanding of the role any given technique or treatment plays in that picture.

The second principle is that we learn more by participation and clinical interaction than by observation. Through "hands-on" experience in clinical sessions, club members can enhance their treatment-planning skills and learn how to bring an "expert's" touch to the type of cases they treat every day.

In short, successful study clubs help members develop to their maximum potential.

The third principle is the idea that learning with and from one's peers in a structured and supportive environment is the most effective way to master the challenges posed by the dental profession. The study club provides a forum for the delivery of a comprehensive curriculum incorporating all pertinent aspects of clinical dentistry, biology, medicine, the behavioral sciences, and practice and financial management.

When the core and essence of study club programming is interdisciplinary comprehensive treatment planning, the specialists and general practitioners in each club pool their vast knowledge and experience in a collaborative setting to design multiple treatment options, ultimately, for the benefit of patients. Although lectures are an important part of any program, the power of the study club comes in the ability to draw on the greatest resource available—each other. Study clubs are most successful when members learn from members.

In short, successful study clubs help members develop to their maximum potential. It is not just about dentistry. It is about balance struck between professional and personal life experience. The two are intertwined and really cannot be separated.

Today, more than ever, we understand that running a successful dental practice is more than displaying technical expertise. In most cases, success is resultant from mastery in practice leadership, management, and making a real connection with people. The right study club experience will influence and foster personal as well as practice growth and success. Clinicians and staff find more enjoyment in practicing dentistry and patients benefit from the best possible treatment from a team of professionals who are empowered to deliver the most complete care. When study clubs are developed to their potential all of this comes together, benefiting everyone involved.

Editor's note: Although the AACD does not sponsor official study clubs, it provides ample opportunities for members to network, take classes, and virtually connect through various forums and interests, including Accreditation and the jCD.

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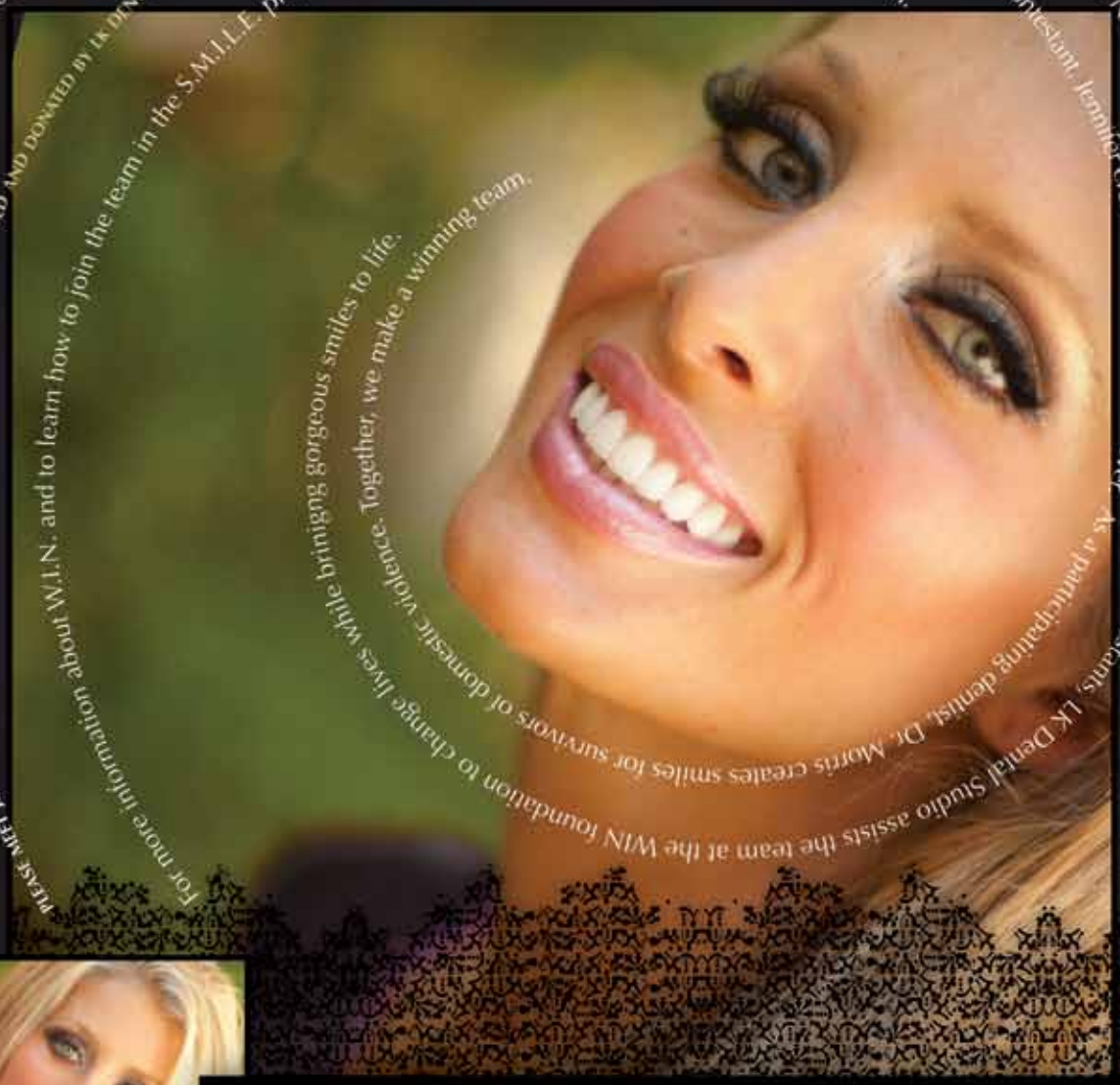

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> "...patients often feel safer when referred to a specialist—particularly in complex situations."

Bernard Touati, DDS

To Refer or Not to Refer, That is the Question

Up Front *provides a forum for influential leaders to share their opinions. In this issue, we welcome Dr. Bernard Touati. Dr. Touati is a visiting professor at the Hadassah Faculty of Dental Medicine, Jerusalem, and owns a private practice in Paris, France.*

Disclosure: The author did not report any disclosures concerning this article.

Dentistry is a complex medical specialty, with multiple disciplines that have undergone significant developments in recent years. As a result, the body of knowledge and the experience required for one to practice "comprehensive" dentistry is so vast that no professional can truly be competent and up-to-date in every discipline. In fact, some disciplines have become "reserved" for dentists who pursue additional specialization, such as orthodontics, endodontics, oral surgery, and periodontics, to name but a few.

Given today's patients' ever-increasing demands for perfection, and the tendency of most dentists to err on the side of caution, it is now common for general practitioners to refer patients to a specialist during treatment. Furthermore, patients often feel safer when referred to a specialist—particularly in complex situations.

The general practitioner, however, plays a critical role even in the referral process. He or she is still responsible for making the proper diagnosis and coordinating communication among the specialists. The general practitioner also has to understand—whether or not he or she can actually perform the required procedure—the capabilities and role of the specialist(s) and must serve as a vital, involved member of the treatment team.

This is particularly true in implant dentistry and esthetic dentistry where, over the past three decades, considerable procedural and technological advances have occurred. In implant dentistry, although the overarching objective is to be minimally invasive, the perfect and natural integration of a prosthetic restoration to its surrounding tissues frequently requires grafting procedures and advanced prosthetic options. In cases involving tooth extraction and immediate implantation and/or temporization, the treatment must combine different surgical and prosthetic skills in order to be esthetic and absolutely inconspicuous.

Thus, implant dentistry can be the very embodiment of this challenge, as proper care often requires surgical and prosthetic procedures to be conducted simultaneously during one session. Whenever implant stability is achieved, not only should the attending clinician understand the impact of the involved biological factors; but also, in the anterior zone, for example, their impact on staging of the procedure and the ability to provide immediate esthetics and prosthetic tissue support. Thus, the practitioner who masters multiple disciplines can achieve many goals, such as patient comfort, function, proper phonetics, and natural tissue integration in a single appointment. Implicit in the aforementioned is the experience of the operator in implantology, prosthodontics, and even periodontics since it is often mandatory in the esthetic zone to perform connective tissue grafting in conjunction with implant placement.

In managing edentulous patients, the experienced and well-read general practitioner should anticipate in each instance the ability to provide immediate function (i.e., an immediate temporary bridge) that respects occlusion, esthetics, phonetics, lip and cheek support, and last, but not least, soft tissue conditioning. Accordingly, while we do understand the need for a multidisciplinary approach involving different specialists, there are situations in implant dentistry when, in the best interests of the patient and of tissue integration, the general practitioner must have the commensurate skills and knowledge to blend together implant surgery, periodontics, and prosthodontics into a single, effective solution.

Esthetic implant dentistry is an ever-changing facet of our profession. The increasing predictability of immediate temporization following the connection of custom and definitive abutments has paved the way for "super" general practitioners, those with a steadily increasing grasp of the involved intangibles—able to achieve what writer Antoine de Saint-Exupéry described as, "What is essential is not visible to the eyes."

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NET-"WORKING"

It is incredible that a happy patient moved to another state and was able to continue to refer patients; this emphasizes the importance of treating all of our patients the best we possibly can.

It is fascinating to discover how patients learn about our practice for the first time. While my marketing budget serves a purpose, it is no surprise that a majority of patients are referred by an existing—and incredibly loyal—patient base. Dani was no exception. A former patient had had porcelain veneers placed in our office months earlier and, shortly thereafter, relocated to Miami, Florida, where she met Dani (this issue's cover patient). Dani admired her smile and was told that the work was done by our office, in Northern Virginia. I received an e-mail from Dani expressing interest in a smile consultation. After reviewing Dani's case (her e-mail had provided excellent photographs of her smile from different angles and she described her current smile and her desired changes), I wanted to steer her in the right direction with respect to appropriate treatment options and where she might seek similar treatment closer to her home in Miami.

After a lengthy discussion and reviewing cases on our Web site together, she decided to make the trip from Miami to my office.

On the day of her appointment, I reserved a significant amount of time to ensure that we would be able to deal with any unforeseen issues and to take the preoperative photographs and radiographs. Dani was the perfect patient—she came prepared to discuss her smile design both with images of smiles she loved, as well as smiles she disliked. She knew exactly what she wanted and how to convey that information, and she was happy to include my team in shade and shape selection. In short, everything worked out just as it should!

We were both more than pleased with the result. She said, "I appreciated that everyone involved listened to exactly what I wanted to accomplish, and this was communicated very effectively to the dental laboratory, which created the smile I had always dreamed of. I couldn't be happier with my smile makeover and the confidence it has given me!"

Cases such as these can truly help to grow our practices. As a result of one happy patient moving to Miami, I was rewarded with the opportunity to meet and treat Dani—an ideal patient with an ideal outcome. It is marvelous that a happy patient moved to another state and was able to continue to refer to our practice; this emphasizes the importance of treating all of our patients the best we possibly can.

For information on the clinical aspects of this case, please turn to page 52.

Restorative dentistry and clinical images: Hamada Makarita, DDS, MAGD, FAACD (Oakton, VA). Laboratory technician: Ryan Chung (Golden Vertical Ceramics; Oakton, VA). Cover photography: Gary D. James (Miami, FL). Cover photos shot with a Canon (Lake Success, NY) EOS-5D Mark II camera.

Preoperative

Postoperative

Long Distance is *No* Distance

Social media sites make it easy to share experiences and opinions with people across the globe. Thanks to social media, Dr. Makarita's successful restoration for one loyal patient led to an unexpected and exciting chain of events.

A loyal patient moved to Miami, where she works with Dani. Dani admired her new co-worker's smile, which led to a referral to Dr. Makarita. Dani decided to travel from Florida to Virginia to have her smile restored by Dr. Makarita. Immensely pleased with the results, Dani posted pictures of her smile makeover on Facebook. Repeating the cycle, a complete stranger, Veronica (pictured below with Dani and Dr. Makarita), noticed her smile and asked where she had it done. Via e-mails and photographs, Dr. Makarita collaborated with Veronica, who also traveled to Virginia for a smile makeover.

As a result of one happy and loyal patient, Dr. Makarita acquired two more. Goodwill multiplies, and with the help of the Internet and social media sites, it multiplies even faster.

Acknowledgment: The author thanks Karsten Klimmek (MACSTUDIO by Microdental Laboratories; Dublin, CA) for fabricating the restorations for Veronica's smile.

Insights From an Educator Who is Both Dentist and Ceramist

An Interview with Dr. Christian Coachman

Christian Coachman, DDS, CDT

Christian Coachman, DDS, CDT, will be presenting at the 28th Annual AACD Scientific Session in Washington, DC. On May 2, 2012, his topic will be "Contemporary Approach to Smile Design—Conservative to Comprehensive." On May 3, he will discuss "Esthetics with Implants, Periodontal Plastic Surgery, and Ceramics." In this interview, Dr. Coachman answers thought-provoking questions from the *jCD* Editorial Review Board. Dr. Coachman will also be giving an AACD webinar in February, presented by the *jCD*, about his Digital Smile Design concept.

Christian Coachman: Dentist, technician, and educator.

Q: It is obvious from your work that you know what "natural esthetics" is and your knowledge of its essential components lets you create it. Who and what inspire your work and daily life to get to this level?

A: I think it is most important to have good mentors, teachers, and models to follow **(Fig 1)**. At the beginning of our career we need to identify and try to create a good relationship with them, showing motivation, respect, and humility; and make them feel we are worth the time they are investing in us, and to share their knowledge. The other important inspiration comes from the patient, knowing that we are treating a human being and that we are enabling them to have a better smile.

Q: How do you see the role of metal-ceramic restorations in the future, in light of the ever-growing metal-free technology that is currently embraced so widely by dentists worldwide? In your opinion, what are the major drawbacks of both the metal-based and the metal-free approaches and how do you work around them in the cases that you do?

A: I think that metal-free restorations are the future **(Fig 2)**, but there are still some issues to be resolved. I still do some metal-ceramic restorations, mainly on implant screw-retained restorations. When doing single units and small anterior bridges, my choice is always metal-free restorations. One of the gaps in restorative dentistry today is how to achieve resistance and long-term stability in large bridges with zirconia. The day that we achieve this we will probably eliminate the need for metal. The other factor is the cost. In many countries, it is still much cheaper to do non-precious restorations than to do zirconia. So it is likely that when this technology becomes less expensive the metal will be eliminated from dentistry. I believe this will still take a couple of years or maybe a decade.

Q: Most of us would agree that fabricating multiple ceramic units for the anterior segment (crowns or veneers) does not pose a major challenge with regard to form and color, as the ceramist has the ability to be creative and generate results that are very pleasing. The single unit is the "Achilles heel" for clinicians and ceramists alike. Being one who combines both areas of expertise, what recommendations do you have for our readers to help them minimize errors and achieve the highest percentage of success in both arenas?

A: I really don't agree with this statement. I believe that the most difficult thing in restorative dentistry is to make multiple anterior restorations look completely natural.

Figure 1: Dr. Coachman with Mr. Willi Geller, one of his mentors and sources of inspiration.

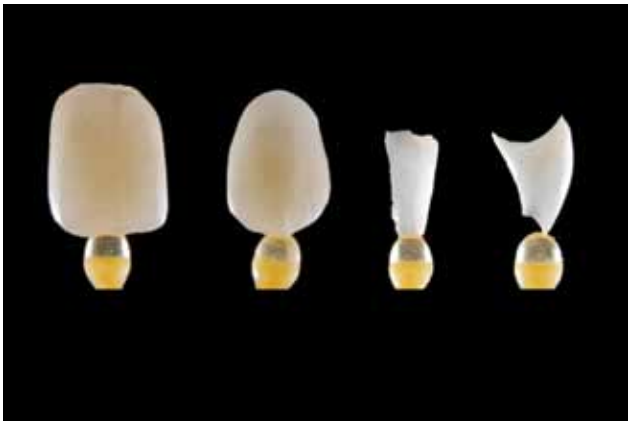

Figure 2: Metal-free restorations showing ideal light transmission.

Figure 3: Single-unit ceramic restoration with its specific challenges of matching color and texture.

Figure 4: Full upper restored with ceramic veneers. On these cases, the main challenge is to create ideal tooth shape and smile design.

Figure 5: CAD/CAM technology. The computer will take over many steps in the lab, but the need for a designer will always exist.

Figure 6: The Digital Smile Design protocol helps us with the esthetic planning process and with long-distance team communication.

On a single unit the challenge is the color **(Fig 3)**; on a full upper case the challenges are shape and design **(Fig 4)**. It is much more difficult to teach someone to see and achieve nice shapes than to work with color. The great ceramists are those that have a tri-dimensional vision of the smile; and the creativity, intuition, and hands-on skills to work with shapes and arrangements to become a "smile designer." People should think about that and change their focus. As a ceramist, I invest much more time in designing a smile that fits the patient's facial features and emotions.

Q: **Due to your international cooperation, did you find different philosophies or techniques in terms of cosmetic dentistry in the various countries, or is there a general consideration?**

A: I see both things happening. Most of the top dentists around the world have similar ways of working. The world is becoming smaller and smaller and information is very accessible. Therefore, the main techniques are similar everywhere among good dentists.

What I noticed are the different approaches to patients, and how esthetically driven these patients are. These factors depend more on the culture of each place. For example, in the United States and in Turkey, we usually see more patients asking for treatments purely because of esthetic reasons. In Europe, people are more conservative and it is harder to convince patients to have some procedures just because it will make them look better. I would say that in northern Europe people are more conservative and in southern Europe, for example, Italy, there is a slow move toward more esthetic treatments. Brazil is somewhere in between and I see a nice balance between functionally, biologically, and esthetically driven treatments.

Q: **Being a well-known ceramist and a dentist, what is the composition in your daily work? Does sharing the two worlds sometimes create conflicts?**

A: No conflicts... I consider myself more a ceramist than a dentist. This will probably change now as I've been doing less ceramics and moving toward more clinical work. I would say that today the composition in my daily work is one-third dentist, one-third ceramist, and one-third lecturer.

Q: **Dental manufacturers and many clinicians believe that the future is computer-assisted design/computer-aided manufacturing (CAD/CAM) and the digital ability to create lifelike ceramic restorations without using a master dental technician. What are your feelings on the future role of the dental technician, and will this job become obsolete in the future?**

A: Great question. The future is definitely about the "digital world": CAD/CAM, digital impressions, digital design, guided surgery, planning software, etc. **(Fig 5)**. The goal should be to use technology to make the whole process easier and allow more people to perform high-quality work, and I think that this is happening. But, technology will never substitute for an artist. Someone will always have to be behind the machine, interact with the patient, have the feeling for beauty, the eye for esthetics, imagine and envision the ideal design, and do final adjustments when it comes to forms and colors. The point is that the technician of the future will be different... maybe more a "digital designer" than a waxer or ceramist. Technicians shouldn't be scared, we just need to be ready to adapt and enjoy these changes. Good professionals will always have work and, when it comes to dental restorations, there will always be a huge need for people with artistic talent!

Figure 7: The pink hybrid restoration is a good alternative for very challenging ridge defect cases inside the esthetic zone.

Q: The U.S. is increasingly outsourcing dental laboratory work to offshore operations. Educational facilities, which formerly trained U.S. dental ceramists, have closed in massive numbers. How do you think this will affect the future of dental care in the U.S.?

A: Tough question. There are some things/processes that we just can't stop. The market will always demand better and cheaper products. When the issue of outsourcing started a number of years ago, the work coming from these places was very bad, but I have to admit that lately I've been seeing some very decent work with amazingly cheap prices. Some of these laboratories are very well equipped and have the quality control and the supervision of good and experienced European/Asian technicians. Again, as a ceramist, I'm absolutely not afraid of this. I think there is space for everybody and all levels of work. If a lab in China is doing less expensive work than I do with similar quality, congratulations to them! This should push people to do things differently. I do think there will be no room for average technicians working in average-size labs. Either you will have highly skilled technicians working in nice studios, or huge labs producing decent and less expensive work. So there are only two choices in my opinion: either you prepare yourself to be very good or you can work as an employee in one of these big labs.

Q: You are able to achieve amazing esthetic results even when working with counterparts in locations around the world. Can you share with us the communication protocols and tools you utilize to get these results predictably?

A: Yes, that's true. I've worked in different places around the world and the main issue was always how to manage the distance and communicate precisely, effectively, and quickly. This is so important that it became one of the main topics of my lectures. You have to develop protocols. In my case, digital communication became the answer. We developed the Digital Smile Design protocol to help us with that and it has been amazingly effective **(Fig 6)**. The protocol consists of utilizing a simple slide presentation software in which to place patients' images, videos, notes, x-rays, etc. On top of these slides we develop some drawings and lines to better understand the esthetic issues and visualize the treatment options. These slide presentations are easily shared with the whole team through the Internet; it doesn't matter where the team members are. The key is to communicate visually instead of by writing or talking. In some situations we were able to do a case from A to Z in a very nice and smooth way without even talking among the team members because we had this online visual, digital communication.

Q: What do you feel are some of the most innovative and new options for dealing with ridge deformities and lost dimensions?

A: That's a delicate subject...The biggest challenge in esthetic dentistry is how to manage soft tissue defects inside the esthetic zone. As I learned working with some of the best surgeons in the world, there are huge surgical limitations when trying to vertically restore the ridge. Redeveloping papillae between two missing teeth is very difficult and sometimes impossible depending on the size of the defect. I hope that researchers and scientists will come up with a solution, but I don't see one in the near future. The problem is that the patients with these mutilations don't want to wait too long to be able to smile again and have a normal social life with confidence. For patients that are really looking for an esthetic solution and for whom more surgery is no longer the best option, we have been utilizing artificial pink materials to replace the missing soft tissue. We developed a technique that combines pink ceramics with direct pink composite to help us blend in these types of restorations **(Fig 7)**.

Q: What do you feel are some of the most exciting and new technologies present or emerging in the near future? What new materials show the most promise?

A: I think that esthetic dentistry is very exhilarating. It is a stressful but captivating profession. Many exciting things are happening lately. I think one of the things that changed my professional life recently was the emergence of lithium disilicate **(Fig 8)**. It really simplified my job in many different aspects. The improvement of zirconia is also very nice to see. Of course the CAD/CAM technology is amazing and it is now possible to do chairside CAD/CAM restorations in a couple of hours. Digital impressions and milled models also will completely change our restorative "life." **jCD**

Good professionals will always have work and, when it comes to dental restorations, there will always be a huge need for people with artistic talent!

Figure 8: Materials such as lithium disilicate and zirconia have changed the way we work, increasing treatment options and the esthetic quality of the restorations.

Dr. Coachman earned his DDS at the University of São Paulo, Brazil, in 2002, and his CDT in 1995. Dr. Coachman, who lectures and has been published internationally, is part of a family practice in São Paulo.

Disclosure: Dr. Coachman developed the Digital Smile Design protocol with the help of Dr. Marcelo Calamita and Mr. Livio Yoshinaga, both from São Paulo, Brazil.

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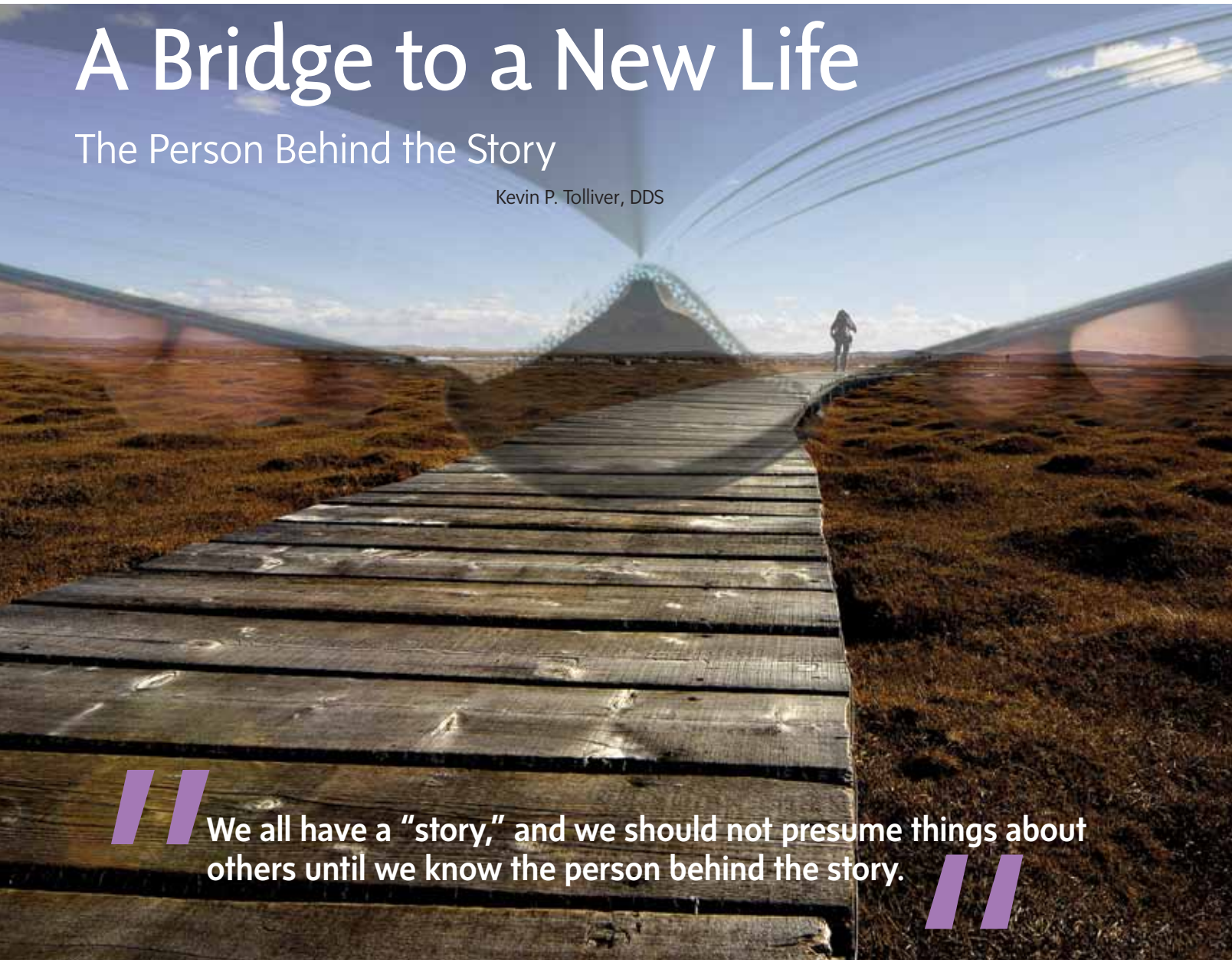
A Bridge to a New Life

The Person Behind the Story

Kevin P. Tolliver, DDS

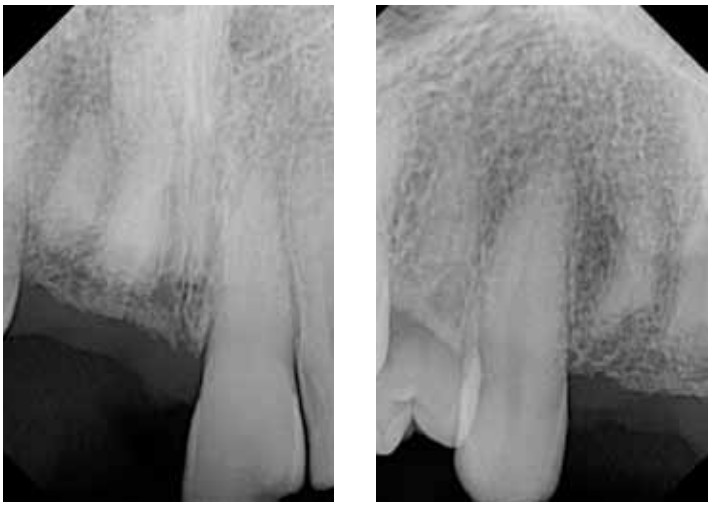


> We all have a "story," and we should not presume things about others until we know the person behind the story.

Introduction

Scott was referred to the AACD's Give Back a Smile (GBAS) program by a social worker at the university where he was enrolled. I have been a GBAS volunteer for several years, and readily agreed to see Scott for an evaluation.

Figure 1: Preoperative, full-face view.



Figures 2a & 2b: Upper anterior, retained fractured roots, #7 and #8.

Background

Scott's GBAS application described a rather tumultuous background. He had recently been released from prison. Unlike most domestic violence issues, where the male is the abuser, Scott had been abused by his ex-wife. He reported she had bit him, cut him, burned him with cigarettes, and thrown things at him. However, what eventually brought him to my office was that she hit him in the mouth with a baseball bat, knocking out the two upper and two lower incisors.

Although I expected a tough, hardened person, I was surprised to find Scott to be very friendly, engaging, and appreciative. Trying to put his life back together, he had enrolled in a university and was looking for a job. He was suffering from extremely low self-esteem. In addition to a rocky history of which he was embarrassed, he felt that people, particularly his new wife's family, looked down on him due to his lack of front teeth, causing him to never smile.

I was touched by his sincerity, and told him I would love to help him get his smile and self-esteem back. My initial encounter with Scott reinforced what I knew, but had obviously forgotten—we all have a "story," and we should not presume things about others until we know the person behind the story.

Findings, Diagnosis, and Treatment Plan

Scott definitely needed dental help **(Fig 1)**. Examination and radiographs showed the retained roots of teeth #7 and #8, which Scott had reported were causing significant pain **(Figs 2a & 2b)**. In addition, the trauma had caused a significant alveolar fracture, resulting in a large defect in his maxillary ridge **(Fig 3)**. Fortunately, teeth #25 and #26 were totally missing, with no remaining roots and no alveolar defects.

Did You Know

- 1 out of 14 men have been physically assaulted by an intimate partner or spouse.
- It is estimated that 835,000 men are physically assaulted by an intimate partner or spouse each year in the United States.
- According to the National Center for Victims of Crime, men experience many of the same psychological reactions to violence as women, including:
  - guilt, shame, and humiliation
  - anger and anxiety
  - depression
  - withdrawal from relationships.

Source: National Coalition Against Domestic Violence, http://www.ncadv.org/files/MaleVictims.pdf

Figure 3: Preoperative, close-up of anterior teeth.

Tooth #9 was dark, and Scott reported there was pain in that tooth. Fortunately, all other teeth in the area were caries-free and periodontally sound. Due to the overall health of Scott's mouth and his good oral hygiene, I felt comfortable with the long-term success of restoring Scott's dentition. I emphasized the importance of continued meticulous hygiene for long-term prosthetic success.

Several treatment options were considered and discussed with Scott. These included implant-supported restorations, fixed bridges, and removable partial dentures. Scott preferred not to have to wear anything removable, with which I concurred. Implants, while feasible for the mandibular arch, were not a good option for his maxillary arch due to the large bony defect. Since he and I agreed that a fixed bridge seemed to be his best option in the upper arch, Scott said that he did not want to wait the required time for integration of lower implants, and would prefer a lower fixed bridge as well.

Of necessity, Scott's treatment plan was multi-phased. First, we needed an evaluation and consultation to determine whether endodontic treatment would be required on dark #9. Second, a surgical consultation was required for the removal of the residual root fragments of #7 and #8, which appeared to be the source of Scott's lingering pain. Finally, assuming no surprises from the endodontic and surgical plans, I would place a four-unit Lava bridge veneered with porcelain (3M ESPE; St. Paul, MN) bridge on the upper arch (which might have had to be expanded to five units if endodontics was required on #9), and a five-unit Lava/porcelain lower anterior bridge (Glidewell Laboratories; Newport Beach, CA). Preoperative models and records were taken for a diagnostic wax-up[1] and a Sil-Tech (Ivoclar Vivadent; Amherst, NY) temporary stent to ensure "Golden Proportion,"[2] proper lip support, and ideal phonetics, and to maintain control of optimal esthetics throughout the case.

Limitations and Challenges

Scott had faced many challenges and was ready and motivated to make some major, positive changes in his life. He had been without his front teeth for seven years, and knew that never being able to smile would be a definite hindrance, career-wise and socially. He felt that regaining his smile was an integral part of turning his life around. I was highly motivated to partner with him in this phase of his life change.

The biggest challenge in restorative terms was the large bony defect from the trauma to his maxillary ridge. Fortunately, he had a low lip line and would rarely, if ever, show any gingivae, even in full smile. Nonetheless, I fully discussed this challenge with Scott, and went over the possible treatment options for handling the defect. I told him we would make a final determination after viewing his provisional restorations in place.

In most other respects, Scott made my job fairly easy. He was a very motivated, eager, cooperative, and grateful patient. He said he was "putting his smile in my hands," and would trust my judgment.

Treatment

The first step was obtaining an endodontic evaluation for dark tooth #9, which looked necrotic. Dr. John Slavens (Northside Endodontics; Indianapolis, IN) very graciously evaluated Scott free of charge. His determination was that #9 was, surprisingly, vital and required no treatment.

Next, we had the residual root fragments of #7 and #8 surgically removed. Dr. Denise Flanagan (Indianapolis, IN) removed both root fragments, and we let Scott heal for eight weeks to allow for stabilization of his maxillary ridge, and for esthetic pontic placement. Dr. Flanagan's fees were paid through the GBAS program.

Eight weeks after the residual root fragments were removed, I determined that Scott's maxillary ridge was stable, and we could proceed with his prosthetics. The day of his scheduled preparations, he came to the office and was extremely excited that the big day had finally arrived. I anesthetized him, and just as I was about to begin the

preparation, I received an urgent call that necessitated my having to leave immediately. I dreaded telling Scott that I had to leave, forcing me to reschedule him, after he had looked forward to this day; however, he was great about it!

Two weeks later, we were finally able to begin Scott's prosthetics. Preparations for an upper Lava bridge from teeth ##6-9, and ##23-27 were done. A Sil-Tech guide was used to ensure preparations that were ideal to facilitate the end esthetic result I had envisioned. Another Sil-Tech stent was used to fabricate the provisional restorations with Luxatemp bis-acryl (DMG America; Englewood, NJ), shade A2. Some adjustments were made to allow for a proper smile line[3]; once that was accomplished, the provisionals looked great and blended beautifully with Scott's facial structure, lip drape, and the rest of his arch structure. We also determined that, because of Scott's low lip line, it would not be necessary to add pink porcelain to the cervicals of the two upper pontics.

Glidewell Dental Laboratories kindly donated their services and expertly and artistically crafted Scott's case. The final restorations were tried in, the fit verified, and the esthetics and phonetics were approved. Both Scott and I were very pleased with the results.

Rewards

Seeing the glow on Scott's face when he first saw his new smile was amazing **(Figs 4 & 5)**. He told me he had believed he would *never* have a nice smile again. However, he said now he would never hesitate to smile.

It is hard to fully express how rewarding this experience was for my dedicated team and me. Scott could not have been more appreciative and was a pleasure to work with. I feel blessed to have had some part in his life transformation. Not only does GBAS give us a chance to impact the lives of those who have suffered domestic violence, but it also impacts our lives. Dentistry is a wonderful profession because it allows so much opportunity for us to give back, if we are only willing to open ourselves to the possibilities to serve.

Figure 4: Postoperative, close-up of anterior teeth.

Figure 5: Postoperative, full-face view.

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Disclosure: The author did not report any disclosures.

Emulating Nature with Dental Implants

Diagnosis, Planning, and Communication for a Predictable Esthetic Outcome

David K. Chan, DMD

Figures 1a & 1b: Preoperative retracted 1:1 lateral views.

Introduction

The undetectable replacement of missing anterior teeth can be considered the ultimate challenge for the cosmetic dentist.

Such treatment demands that the clinician possess a thorough understanding of the biologic principles of the interaction of hard and soft tissues. The management of missing anterior teeth with endosseous dental implants is often the most conservative treatment of choice for the patient, and dental implants can provide a predictable esthetic result.

However, a successful outcome depends on scrutiny of a number of key points, such as implant position (buccal/lingual/incisal), gingival biotype, tissue contours, restoration emergence profile, and laboratory and specialist communication. Incorporation of these key points may often involve different clinical disciplines and members of the clinical team.[1]

Case History

The patient was a 48-year-old, non-smoking male in excellent health, with two congenitally missing maxillary canine teeth and failing, retained maxillary deciduous canines. He had sought regular preventive dental care over the years. The patient's goal was an esthetic, conservative, and permanent solution for his congenitally missing canines **(Figs 1a & 1b)**. His oral soft tissue health and oral hygiene were in excellent condition. Radiographic, occlusal, and temporomandibular examinations were also unremarkable.

Figure 2: Diagnostic wax-up of the canines to identify the location of the free gingival margins and the buccal/lingual orientation of the restorations.

Figure 3: The top of the implant fixture was to be placed 3 mm apical to the free gingival margin.

Clinical Findings

The patient received a comprehensive clinical examination. He presented with a Class I occlusal relationship with a 25% overbite and 3-mm overjet. His permanent maxillary canines were congenitally missing and the retained deciduous canines were failing, both esthetically and functionally. A thorough radiographic examination utilized a full-mouth series and a CT scan (i-CAT Imaging Sciences International; Hatfield, PA), which revealed excellent bone morphology in the area of teeth C and H.[2,3] During the examination it was noted that there were recurrent caries in tooth C, and both deciduous maxillary canines had Class II mobility. It was also apparent that C and H were very dark and did not blend or harmonize with the patient's smile.

The clinical examination indicated the following conditions:

- retained deciduous maxillary canines, C and H
- congenitally missing maxillary canines, #6 and #11
- thick gingival tissue biotype
- ideal bone/tissue contours in area of C and H.

Treatment Plan

From the diagnostic data, the following treatment plan was formulated:

1. mounted study models
2. diagnostic wax-up of teeth #6 and #11 for implant-supported crowns
3. extraction, C and H
4. enamelplasty, distal #7
5. endosseous dental implants, #6 and #11 (immediate placement)
6. bone graft, #6 and #11
7. Essix retainer (Dentsply Raintree Essix Glenroe; Sarasota, FL)
8. custom provisional crowns, #6 and #11
9. custom UCLA abutments, #6 and #11
10. porcelain-fused-to-metal (PFM) crowns, #6 and #11.

Treatment

The primary goal of the treatment was based on the least invasive option for replacement of the missing canines #6 and #11. One of the key factors in choosing an implant-based solution for this care is the ability to obtain an esthetic result without involvement of the adjacent teeth. Digital photographs and radiologic imaging were used to evaluate the tissue contours, papillae height, bone morphology, and free gingival margin location of the final restorations before commencing any treatment. In the planning phase, clear communication with any specialists should take place with these key points in mind:

1. The location of the teeth that are to be replaced. This criterion can easily be met using diagnostic wax-ups that allow previewing the esthetics and location of the teeth. A few things to consider are the location of free gingival margins and buccal/lingual orientation of the restorations **(Fig 2)**.
2. The required depth of placement of the implant. This criterion can be met by using a surgical guide fabricated from a duplicate stone model of the diagnostic wax-up. A very simple method to fabricate a surgical guide is to make a vacuum-formed stent over the duplicate stone model. The information provided by the stent will give the surgeon the depth required at the gingival level for implant placement as well as its

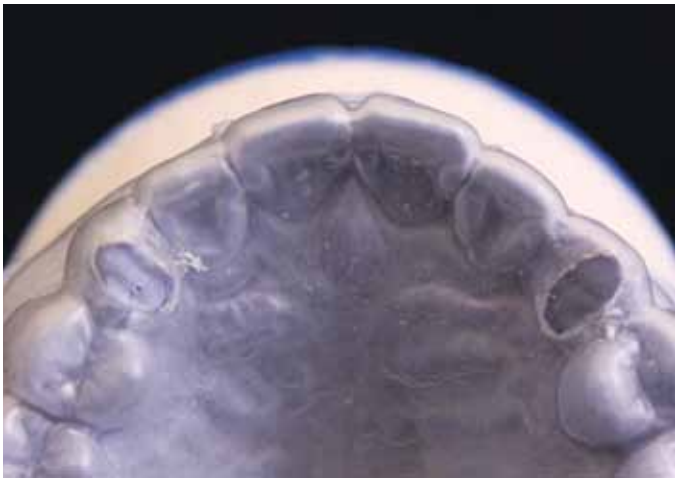


Figure 4: A clear surgical guide to aid the surgeon in orienting the trajectory of the implant osteotomy.

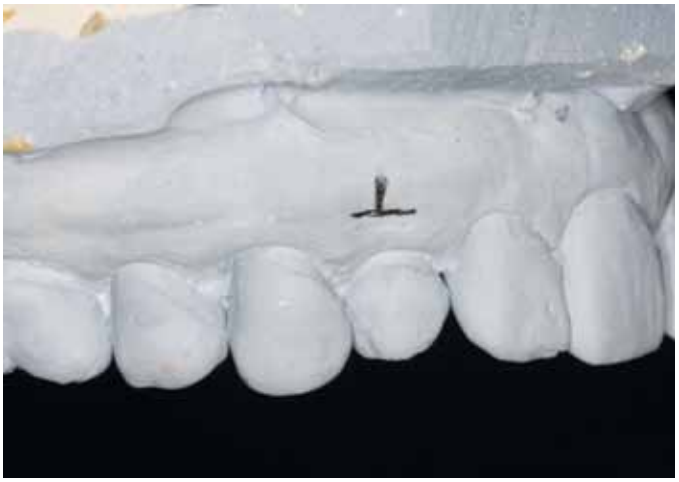


Figure 5: The implant is to be placed apical to the height of the native osseous crest.

buccal/lingual orientation. In this particular case, the top of the implants were placed 3 mm apical to the free gingival margin **(Fig 3)**. The buccal/lingual trajectory of the implants was determined by drilling holes through the surgical guide to allow the surgeon to visualize the orientation of the drill in relation to the final restoration **(Fig 4)**.

3. Photographs to evaluate the three-dimensional contours of the hard and soft tissues. This will aid the surgeon in determining whether any hard or soft tissue augmentation will be required for successful implant placement and esthetic outcome.
4. The entire clinical team must understand the periodontal interactions between implants, natural teeth, soft, and hard tissues.

Study Models and Diagnostic Wax-up

The diagnostic casts were mounted in maximum inter-cuspation position (MIP) with a Kois facebow (Panadent; Colton, CA) and evaluated to confirm there were no major occlusal factors present that might interfere with the proposed treatment.

It should be noted that the restorations over the two implants were restored to include some canine guidance versus a group function scenario. However, it is paramount that for a canine guidance set-up to be successful, the patient must not have any posterior occlusal dysfunction. The current thinking on this matter is that canine guidance over restored implants is acceptable as long as there is bilateral equal/and simultaneous posterior contacts.[4,5]

A full-contour diagnostic wax-up of #6 and #11 was performed on the maxillary mounted cast. The purpose was two-fold: to identify the free gingival margins of the permanent crowns and to serve as a template for fabrication of the provisional crowns. It should be emphasized that the free gingival margin location in the wax-up is of paramount importance since it determines the optimal depth of the implant placement. This step will ensure the distance needed to develop ideal emergence profiles for the final restorations (to have the top of the implant fixtures positioned 3 mm apical to the proposed free gingival margin).

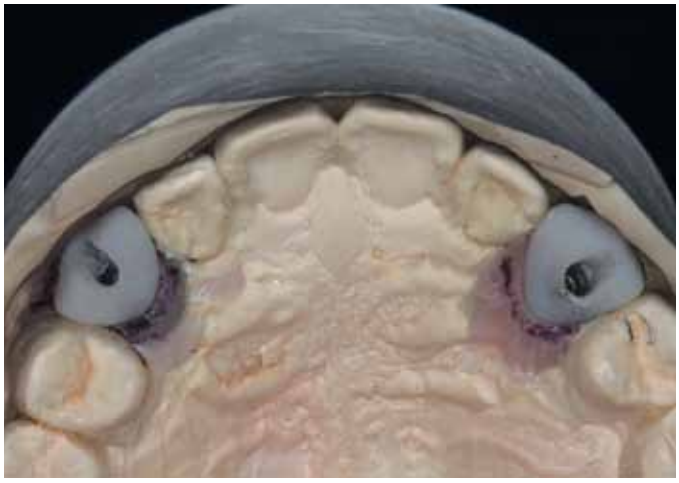
In this case, the ideal free gingival margin of the restoration was at or close to the level of the osseous crest **(Fig 5)**; therefore, the implant needed to be placed deeper to meet the 3-mm implant-gingival margin distance rule. At the same time it was critical that the abutment not place any excessive facial or apical pressure on the soft tissue as this might cause undesirable apical migration of the gingival margin. Unlike the root of a natural tooth, it is best to keep the abutment as parallel as possible to the dental implant until it is just about to emerge from the tissue. The clinician can therefore customize and develop the gingival scallop around an implant-supported crown by modifying only the gingival one-third of the provisional crown.

Implant Placement and Bone Allograft

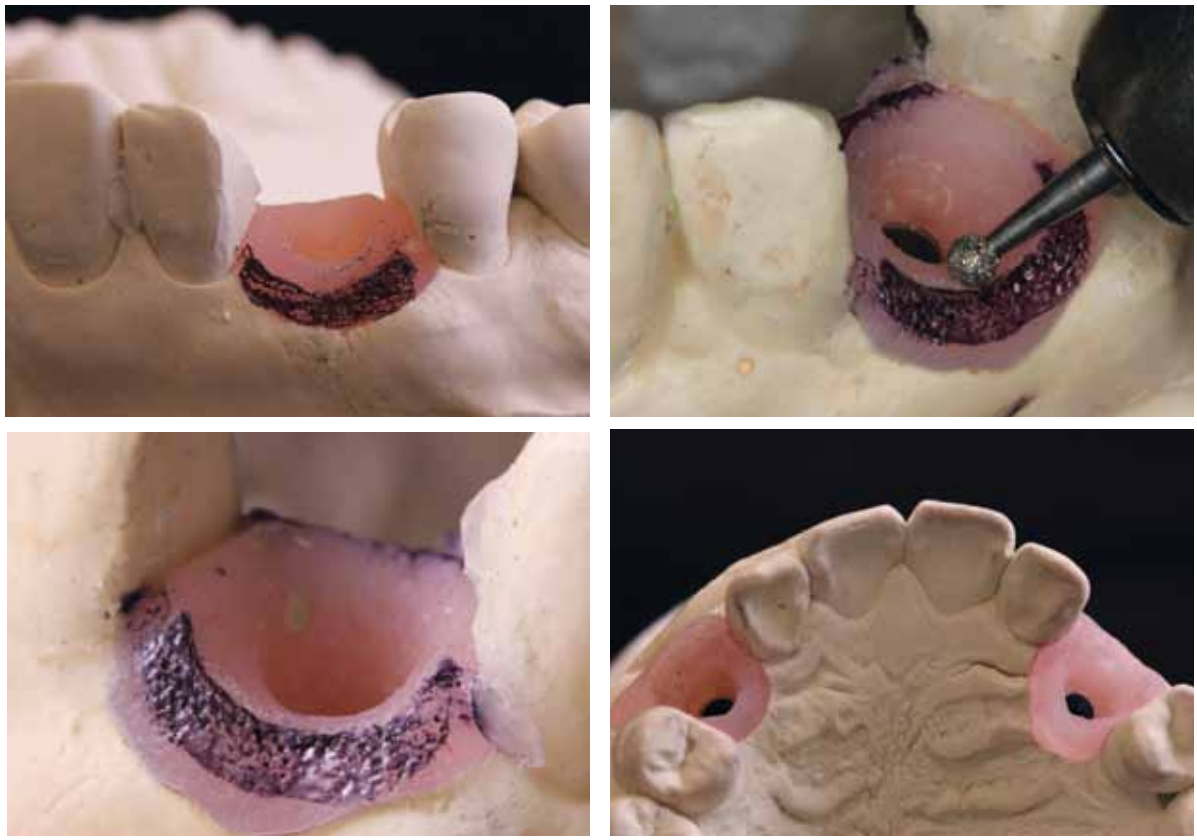
Prior to the surgery appointment, a surgical guide was made from a duplicate stone model of the diagnostic wax-up. The surgical guide was fabricated to have the top of the implants placed 3 mm apical to the free gingival margins of #6 and #11 **(Figs 6a & 6b)**.[6] The surgical guide also assisted the surgeon in angulation of the long axis through the incisal edge of the final restoration **(Figs 7a & 7b)**. The areas of #6 and


Figure 6a & 6b: A surgical guide made from a stone model of the diagnostic wax-up confirms the depth and angulation for implant placement.


Figures 7a & 7b: Surgical guide placed over the master implant model demonstrating proper implant depth and angulation.

Figures 8a & 8b: Master implant model with custom screw-retained provisional crowns.



Figures 9a-9d: Emergence profile being developed by shaving the silicone away, based on the parameters established from the diagnostic wax-up.

#11 were anesthetized with 2% lidocaine 1:100,000 epinephrine (Septodont; Saint-Maur-des-Fossés, France). Once the anesthesia was successful, #6 and #11 were atraumatically extracted with the use of periotomes. Approximately 0.25 mm of enamelplasty was performed on the distal of #7 with a carbide bur, in order to obtain width symmetry when compared to #10. The sockets were then thoroughly curetted and rinsed with sterile saline. The implants chosen were 3.5-mm diameter x 11-mm length two-piece implants (Astra Tech Dental; Waltham, MA). With the aid of the pre-made surgical guide, the implants were then placed into the extraction sockets to the correct depth and buccal/lingual angulations. Particulate 250-1000 micron-sized mineralized cortical-cancellous freeze-dried bone allograft (AlloOss, Ace Surgical; Brockton, MA) was then placed into the sockets to fill in any space between the implant and the socket walls.[7-10] The purpose of a particulate bone allograft is to promote host bone formation by providing a scaffold for native bone cells to migrate in for regeneration and to act as a barrier to prevent migration of granulation tissue into the healing socket.

An index of the implants was taken after their placement to facilitate the laboratory fabrication of both a working model with the implant locations and the screw-retained provisional crowns **(Figs 8a & 8b)**. The indexing process simply involves inserting open-tray impression copings into the placed implants and taking an open-tray full impression at the time of surgery. Indexing the implants at placement allows the laboratory to make an ideal wax-up on a soft tissue model, which can be used to fabricate a very accurate provisional crown. Using a marker, the soft tissue model was marked at the free gingival margin around the wax-up, then the wax-up was removed and the silicone was shaved away to the ink border with a diamond bur. This allowed for the initial stages of developing the emergence profile of the provisional crown **(Figs 9a-9d)**.

Two healing abutments were then attached to the implants and torqued to place **(Fig 10)**. The patient was then fitted with a previously made Essix retainer as an interim prosthesis.

Custom Provisional Crowns

Custom provisional crowns were inserted after four months of healing using local anesthesia for patient comfort. The healing abutments were removed, and then the provisional crowns fabricated from the indexed implant model were torqued to place. The tissue around the

implants was then allowed to heal for two weeks. During this appointment, the bone level of the teeth proximal to the implants was evaluated. The bony crest was sounded using a periodontal probe to ensure that the proximal contacts of both provisional and final crowns were within 4.5 mm to the interdental bone of the adjacent natural tooth. This will minimize occurrence of black triangles interproximally **(Fig 11)**.[11,12]

Using flowable composite, the provisional crowns were removed and their shape altered multiple times in order to influence or "train" the peri-implant soft tissue for a proper emergence profile and gingival architecture according to smile design principles. The tissue training process can be repeated weekly to achieve the desired contours, but should be kept to a minimum because the sulcular epithelium is disturbed every time the custom temporary crowns are removed. By using the flowable composite technique, it is actually the scallop and papilla height of the gingival tissue that is being influenced. Examples of influencing the peri-implant tissue with a custom provisional crown include:

- location of the contact points with the adjacent teeth as it relates to the interdental bone
- shape of the gingival scallop
- location and shape of the gingival zenith.

The final tissue contours were achieved by customizing the gingival one-third of the provisional crown. The provisional crown phase to develop the tissue in this case required a total of two attempts over two weeks.[13]

Once the ideal tissue contours were developed with the provisional crowns, the tissue was allowed to mature for three weeks. Then the provisional crowns were removed and their gingival third was duplicated by taking an impression of the provisional crown's gingival third. This approach involves screwing the provisional crown onto an implant analog that has been embedded in stone and flowing impression material around it, submerging the lower third of the provisional crown **(Figs 12a & 12b)**.

After the impression material set, the provisional crown was unscrewed; there was now a perfect impression of the peri-implant tissue contour. The laboratory technician used this impression to fabricate a custom abutment and the final crown.

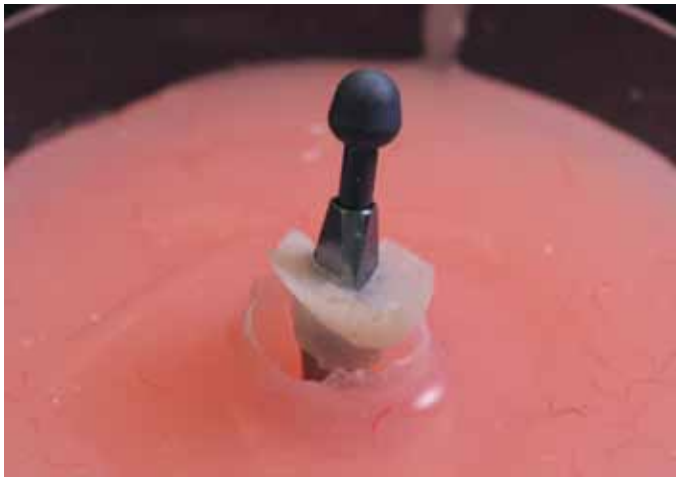
Custom impression copings were made from the impression of the provisional crowns by screwing the stock implant impression copings onto the analogs described previously, and by adding flowable composite into the impression and around the stock impression copings to capture the exact tissue contour developed by the provisional crowns **(Figs 13a & 13b)**. These custom impres-

The management of missing anterior teeth with endosseous dental implants is often the most conservative treatment of choice for the patient.

Figure 10: Healing abutments attached to the implants at the #6 and #11 locations.

Figure 11: The proximal contacts of the custom provisional crown was placed no more than 4.5 mm from the interdental bone of the adjacent natural tooth.

Figure 12a & 12b: The shape of the soft tissue is captured by using the apical one-third of the custom provisional crown.



Figures 13a & 13b: Custom-made implant impression copings.

Figure 14: Custom implant impression coping used to fabricate the master implant model with the ideal tissue contours duplicated.

Figure 15: The shape of the peri-implant soft tissue is transformed to a custom UCLA abutment.

Figure 16: The final crown placed over the custom UCLA abutment.

sion copings were then removed and screwed onto the patient's implants and a full arch open-tray impression was taken using Imprint-2 PVS (3M ESPE; St. Paul, MN). The full arch impression and custom impression copings allow the laboratory to fabricate the master implant model with precise tissue emergence profiles as well as the implant location. This method provides an accurate means of laboratory communication regarding the true tissue contour. Using this method, the ceramist has all the information needed to fabricate an ideal emergence profile for the final restoration **(Fig 14)**.

Custom UCLA Abutments

The laboratory then fabricated custom-shaped UCLA abutments from the master implant model **(Fig 15)**. UCLA abutments were chosen over preparable, milled titanium or zirconium abutments for two reasons: the patient presented with a very thick gingival biotype that would mask any tissue show-through; in addition, they would offer more precise control of margin location, abutment shape, and any abutment fine tuning.[14,15] This allowed the proper angulation development and cutback of the abutment in order to create the ideal crown contours and emergence profile **(Fig 16)**. Once the UCLA abutments were fabricated, they were tried onto the patient's implants and radiographs taken to confirm complete seating. Photographs of the abutments along with the adjacent teeth and shade tabs were taken for laboratory communication and shade mapping.

Restoration

The restorative material of choice was PFM crowns. This particular material was chosen to allow the ceramist to efficiently take control of the abutment design described previously, and to take advantage of the fact that canines can appear extremely natural with slightly elevated chroma and lower value.

Cementation

On the day of cementation, the patient had the provisional crowns removed and the implants rinsed with chlorhexidine gluconate .012%. The custom abutments were torqued to place (20 Ncm) and complete seating was verified with radiographs. The permanent crowns were tried onto the abutments to be evaluated for fit, shade, and shape, to be presented to the patient for final approval.

To prepare for cementation, the crowns were cleaned using a PrepStart unit (Danville; San Ramon, CA) on the internal surfaces with 27-micron aluminum oxide powder and then rinsed thoroughly with water. The abutments were cleaned with fine pumice using a prophy cup and rinsed well with water. Air was used to dry the inside of the crowns and abutments respectively. With the use of warm gutta percha from an Obtura II unit (SybronEndo; Orange, CA), the screw access holes of the abutments were sealed. A thin layer of cement (Improv, Alvelogro Inc.; Snoqualmie, WA) was applied to cover all the internal surfaces of the crowns. The crowns were seated onto the implant abutments and held in place firmly for three minutes to allow the cement to set. The excess cement around the crowns was removed and checked thoroughly for any remaining cement with dental floss and radiographs. Finally, the occlusion of the crowns was verified to be in proper alignment with the rest of the dentition.

Conclusion

The replacement of missing teeth with implant-supported restorations can provide patients with a very conservative treatment option that does not involve any adjacent teeth. The constant evolution of dental implants and soft/hard tissue management guidelines has revolutionized their use in the esthetic zone with very predictable outcomes **(Figs 17a-18b).**

Acknowledgments

The author thanks his ceramist, Mr. Brady Fellman (Fellman Dental Laboratory; La Center, WA), for the skill and time he dedicated to this case; and his many mentors at the AACD for their ceaseless encouragement of his journey toward Accreditation. He also gives special thanks to his wife, Liann, and to his wonderful staff for their never-ending support.

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Figures 17a & 17b: Preoperative and postoperative retracted views demonstrate that implant-supported restorations can truly emulate the beauty of natural teeth.

Figures 18a & 18b: Postoperative retracted 1:1 lateral views.

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Disclosure: The author did not report any disclosures.

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Examiners' Observations

Key Insights for Accreditation Case Type III

Scott W. Finlay, DDS, FAGD, FAACD
Illustrations by Dave Mazierski

Figures 1-4: An ovate pontic design presents the illusion that the missing tooth is actually erupting from the tissue.

In Case Type III, the candidate is challenged to replace a missing maxillary incisor or cuspid to a level of Accreditation excellence. The operator is given the option of replacing the missing dental components with either a bridge or an implant. If a bridge is selected, the accepted standard of excellence is the use of an ovate pontic **(Figs 1-4)**. Replacement of a crown on a pre-existing implant is not acceptable for Case Type III.

The edentulous space must be documented preoperatively with a radiograph **(Figs 5a & 5b)**.[1] The examiners' focus is limited by definition to the replacement tooth and any areas that the candidate has treated. It is not necessarily a case type in which comprehensive smile design criteria are heavily weighed, unless the treatment rendered encompasses a broader field in the smile zone. The candidate must keep in mind that if a limited scope of treatment is selected, the balance of the smile zone should not be visually distracting, as it might indicate the need for additional management. A common problem in this case type is underestimating the time required to establish ideal tissue architecture.

The candidate's case selection and ability to treatment plan are particularly magnified in this case type. It is in the candidate's best interest to find a patient with reasonable periodontal architecture that presents the optimal environment to create excellence. Our goal is to achieve a result so natural-looking it is hard to discern that a natural tooth does not occupy the edentulous space. It is strongly recommended that candidates for every Accreditation case type work with a mentor, especially one who has been calibrated as an examiner.

Successful management and treatment planning demands mastery not only of prosthetic concepts,

Figures 5a & 5b: Preoperative and postoperative radiographs must document the edentulous space or failing tooth to be replaced.

A common problem in this case type is underestimating the time required to establish ideal tissue architecture.

but also of the parameters of health imposed by the periodontal architecture.[2] Although some restorative dentists may provide advanced surgical procedures to their patients, in many cases effective treatment involves an interdisciplinary team. This team typically consists of the restorative dentist and the surgeon, who may be involved in site development or the placement of the implant. Regardless of who performs the surgery (if it is indicated), the key responsibility remains the orchestration of the treatment planning by the restorative dentist with a protocol that will provide predictable, durable, and esthetic results.[3,4]

A predictable protocol begins with a complete understanding of the options to restore the patient's health and function. This protocol starts with a visualization of the desired solution; this is then studied and modulated in three dimensions through the use of diagnostic models and a wax-up of the intended result. From this dental "blueprint," stents can be fabricated and utilized in both the surgical and restorative phases to effectively reproduce the anticipated results.[5] The restorative dentist will find great value in methodically and patiently manipulating the prototype restorations to help establish the best possible periodontal architecture.[6,7]

Dr. Chan should be commended for his fine demonstration of each of these elements of case management and the final result. His conservative approach in limiting the treatment to the edentulous areas of ##6-11 was well within the parameters of this case type **(Fig 6)**. His model analysis and diagnostic wax-up allowed him to make key decisions in managing the spaces and developing the appropriate stents to be used during treatment. His understanding of the biology of the system facilitated his planning in the ideal placement of the implant in three dimensions. His attention to detail in managing the prototype ensured the predictability of the tissue architecture and what appears to be a healthy and sustained result. His keen eye identified those elements of macro- and micro-esthetics that allow the restorations to "disappear" into the surrounding dentition.

The examiners as a group identified very limited criteria that had faults. Most examiners awarded the case a plus one because of the excellence that was demonstrated. The case passed unanimously. Those criteria that accounted for minor deductions included:

Criterion 53: The opacity was slightly high in the cervical one-third of the cuspids.

Criterion 87: Minor asymmetries were noticed in the contralateral teeth #6 & #11

The Accreditation process represents the ultimate challenge in the mastery of dental esthetics. Achievement of this gold standard of excellence will provide immeasurable rewards for you and your patients.

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Figure 6: Although smile design deficiencies existed in the balance of the patient's smile, these criteria were not judged because they are not the primary focus of this case type, they were not treated, and they represented a normal state of health.

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Disclosure: The author did not report any disclosures.

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Evaluate, Study, and Select

12 Tips for Accreditation Case Type III (Implant or Bridge)

James H. Peyton, DDS, FAACD

"Tell both the laboratory technician and the implant surgeon what you are specifically looking for in an Accreditation case."

Figure 1: Diagnostic wax-up of the canines to identify the location of the free gingival margins and the buccal/lingual orientation of the restorations.

1 READ ARTICLES ON CASE TYPE III (especially those in the *Journal of Cosmetic Dentistry*), attend lectures, and take hands-on courses.

2 SELECT A CASE THAT IS FAIRLY STRAIGHTFORWARD and choose a patient who is willing to go through all the procedures and appointments necessary to achieve Accreditation-level results.

3 SELECT A CASE THAT HAS HEALTHY GINGIVAL TISSUE and that has sufficient contour to recreate the lost gingival architecture.

4 USE A GREAT LABORATORY TECHNICIAN. Involve the technician on the case from an early stage and plan the case together. The implant surgeon should also be excellent and involved in the case at an early stage. Tell both the laboratory technician and the implant surgeon what you are specifically looking for in an Accreditation case.

5 TAKE IMPRESSIONS FOR STUDY MODELS. From the study models, create a diagnostic wax-up. With the wax-up, the intended contours can be evaluated **(Fig 1)**.

6 CREATE A SURGICAL STENT TO HELP the surgeon place the implant **(Fig 2)**.

7 EVALUATE THE SOFT TISSUE CONTOUR and evaluate the need for augmentation (connective tissue graft or bone graft).

8 STUDY RADIOGRAPHS OR CT SCANS and determine whether the case can be done properly to create an esthetic and functional restoration.

9 FABRICATE IMPLANT TEMPORARIES THAT ARE SHAPED in the same gingival contour as planned for the final restorations **(Fig 3)**. Similarly, for the bridge case, shape the pontic site to replicate the shape of the final restoration.

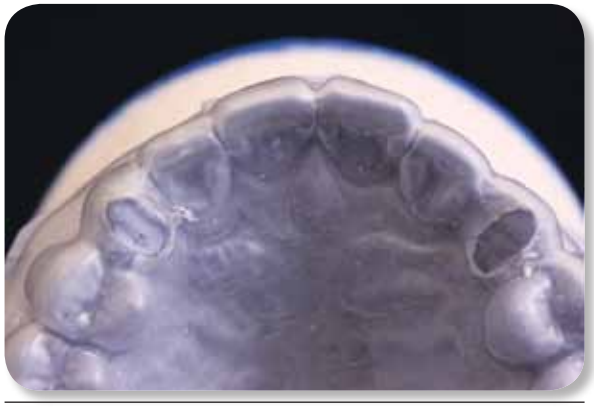


Figure 2: A clear surgical guide to help the surgeon orient the trajectory of the implant osteotomy.

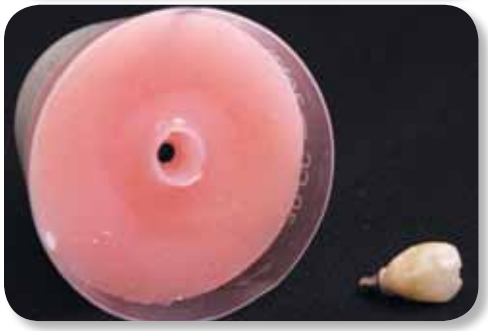
Figure 3: The proximal contacts of the custom provisional crown is placed no more than 4.5 mm from the interdental bone of the adjacent natural tooth.

10 CUSTOM IMPRESSION COPINGS CREATED from the actual temporary can give the laboratory technician valuable information about the intended shape of the gingival contour of the implant crown. A custom impression coping is made from an impression of the gingival area of the provisional crown by screwing the implant coping onto the analog. The analog, sometimes referred to as the "implant replica," was used twice in this case. It was first used in the plastic cup embedded in plaster and pink silicone (Gingitech, Ivoclar Vivadent; Amherst, NY) to capture the shape of the custom provisional crown. The second time the analog was used was in the master model that the ceramist utilized to make the custom UCLA implant abutment and final crowns. The pink silicone was used to capture the contours of the apical one-third of the provisional crown. It is commonly used as a soft tissue replica that helps the lab technician visualize the shape of the soft tissue around an implant. Flowable composite is added around the impression coping **(Figs 4a-5b)**.

11 FOR THE BRIDGE CASE, IT IS IMPORTANT to create a very natural-appearing connector. Avoid making the connector too wide.

12 ALSO IN A BRIDGE CASE, MAKE SURE to create an ovate pontic. This should be established with the temporary; this information must be passed on to the laboratory technician.

Acknowledgment
The author thanks Dr. David Chan for the use of his images for this article.



Figures 4a & 4b: The shape of the soft tissue is captured by using the apical one-third of the custom provisional crown.

Figures 5a & 5b: Custom-made implant impression copings.

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Disclosure: The author did not report any disclosures.

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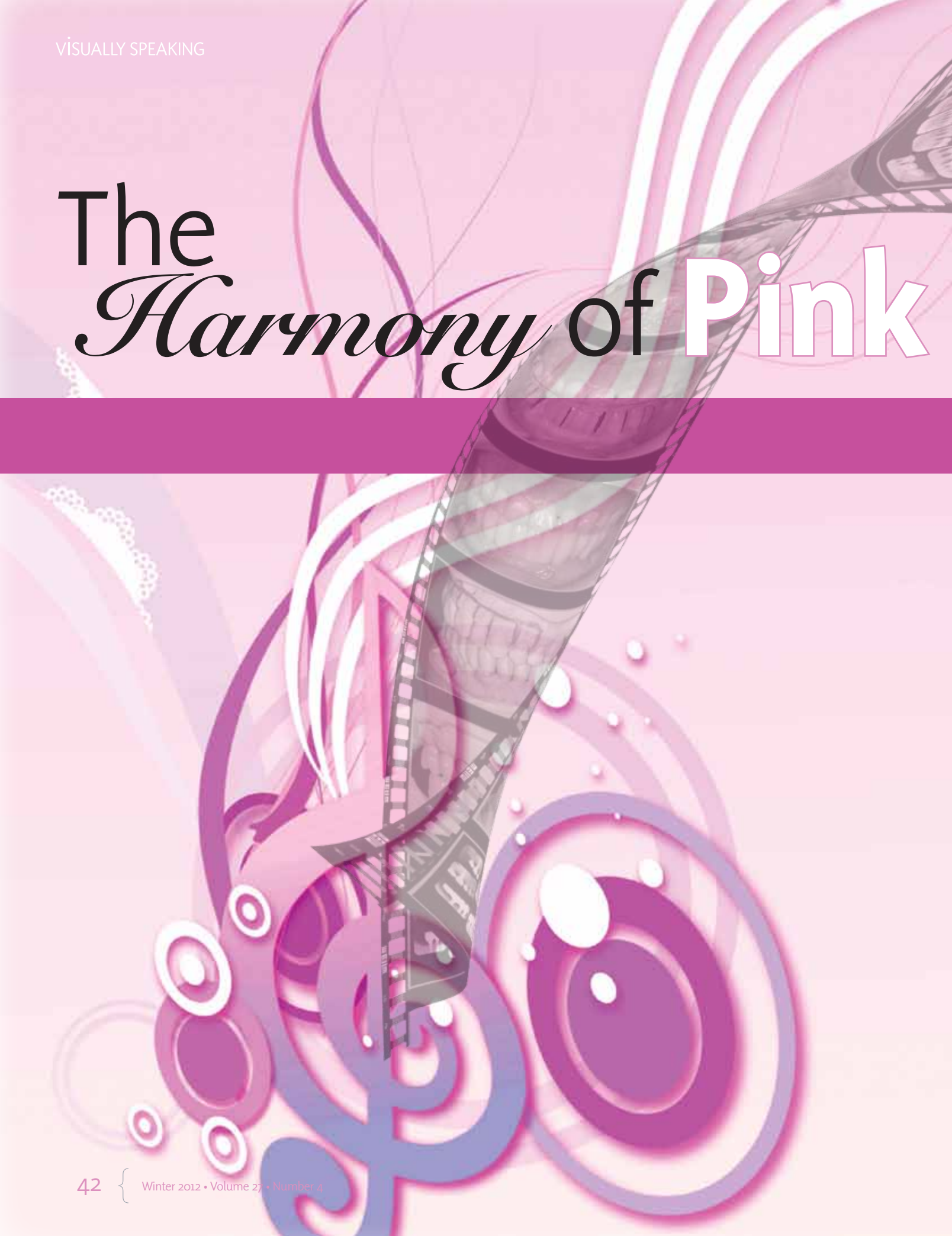


& White

The Beauty and Renewal of Gingivae

You Nino, DDS

INTRODUCTION

Advances in technology have created many options in dental therapy. Implant therapy is becoming widely used to improve patients' oral function and make them satisfied. Clinicians are discovering the anatomical relationship of implant and soft tissue with the limitations of implant therapy. On the other hand, patients are demanding more beautiful smiles. Therefore, it is necessary to consider the harmony of pink and white in esthetic and functional restorative therapy.

A goal was to improve the gingival levels and harmonize with the coronal portion.

"In implant therapy for edentulous cases, it is difficult to

The Things We Know

class	Restorative environment	Proximary limitation	Vertical soft tissue limitation
1	Tooth-tooth	1mm	5mm
2	Tooth-pontic	N/A	6.5mm
3	Pontic-pontic	N/A	6.0mm
4	Tooth-implant	1.5mm	4.5mm
5	Implant-pontic	N/A	5.5mm
6	Implant-implant	3mm	3.5mm

Classification of predicted height of interdental papillae.
(Table adapted with permission.[1])

Key Points of Diagnosis and Planning in Smile Design

The position of central incisors is a point of reference that depends on front face assessment, vertical proportions, and lip-tooth relationship.[2]

- decide the position of central incisors' edge for lip
- change the position of upper molars for one of central incisors
- set position of lower dentition to fit with upper one
- improve the gingival levels and harmonize with the coronal portion.

recover esthetically when the lip line is high."

The Things We Pay Attention To

The percentages of different smile types (low smile 20%, average smile 69%, high smile 11%).[3]

In implant therapy for edentulous cases, it is difficult to recover esthetically when the lip line is high.

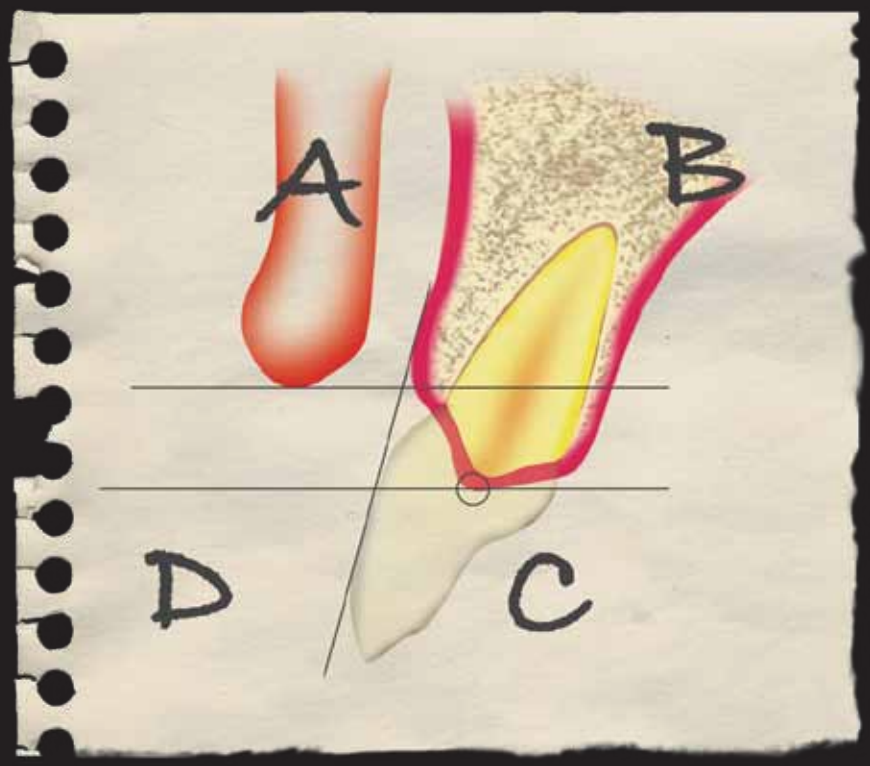
Esthetic problems for prostheses in implant therapy include the following:

- incorrect dental proportion
- inverted smile line
- rectangular teeth and long contacts
- incorrect tooth axis and zenith position.

The Esthetic Quadrant Concept

In view of the four points shown in the Esthetic Quadrant Concept, it is important to make artificial gingivae to improve esthetics in the following areas:

a. lip
b. hard, soft, and implant-surgical zone
c. restorative zone
d. visible zone.[4]



Esthetic Quadrant Concept.

Case 1: Veneers' Natural Beauty

Veneers provide natural-looking beauty. Pink in normal soft tissue enhances beauty. The shape of the teeth depends on the level of dental papillae.

Veneers provide natural-looking beauty (teeth restored: #6, #7, #8, #10, #11).

Case 2

The patient, a 22-year-old female, was very self-conscious about her appearance. She had many cavities and had had orthodontic treatment, which failed. New treatment included extraction of all upper teeth except #16. The oral surgeon placed seven implants in her upper jaw because she rejected a self-removable denture. The author elevated the lower occlusal plane and set a denture with gingivae for the upper. The shape in the bottom of the pontic is flat or convex, making it easier to keep clean. She now has an attractive smile.

New treatment included extraction of all upper teeth except #16.

The shape in the bottom of the pontic is flat or convex, making it easier to keep clean.

Setting provisional restorations with gingivae can harmonize the shade of pink with the lips.

Note the artistic gingivae.

Case 3

The patient, a 50-year-old female, had been unhappy with the appearance of her smile for several years. She presented with periodontitis and cavities. Treatment included extraction of all teeth. An oral surgeon performed a sinus lift and placed nine implants in the upper jaw. The author looked for stable position because the mandibular position was imbalanced. Then the oral surgeon placed eight implants in the lower jaw. Thanks to the full-mouth implant restoration, the patient now has a brilliant smile.

Case 4

The author diagnosed whether the 31-year-old patient's teeth were good or failing after the patient had a primary treatment for aggressive periodontitis. The author extracted all failing teeth and an oral surgeon placed four implants in the upper jaw. An orthodontist moved teeth to decide the incisal position. After that was completed, the oral surgeon placed eight implants in the patient's lower jaw. Making artificial gingivae was necessary to improve the overall outcome and esthetics.

Making artificial gingivae was necessary to improve the overall outcome and esthetics.

Acknowledgments

The author sincerely thanks Dr. Masatoshi Matsukawa (Tokyo, Japan) for his surgical work and Dr. Hatsuhiko Kaji (Tokyo, Japan) for his orthodontic work. He also thanks Yasuhiro Odanaka, CDT (Oral Design; Tokyo, Japan), for the case shown on page 47; Yoshimi Nishimura, CDT (Dental Creation Art; Osaka, Japan), for the case shown on page 48; and Takayuki Kobayashi, CDT (Dental Design Basis; Kanagawa, Japan), for the case shown on page 49. He also expresses special gratitude to Dr. Thomas Trinkner for his kindness.

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The Laboratory Ceramist: *An Integral Team Member*

A Successful Collaboration Creating Veneer Restorations

Abstract

Dental materials and techniques continue to evolve, especially in response to the surge in cosmetic procedures. Dentists are being inundated with material advances and time-saving techniques. Amidst all these developments, however, the interdisciplinary importance of the laboratory ceramist/technician can sometimes be neglected. This article highlights the collaborative relationship between dentist and ceramist, the significance of their partnership, and the relevance of the scientific knowledge and artistic skills possessed by laboratory personnel in the outcome of predictable and esthetic restorations.

Producing esthetically pleasing and predictable restorations is a creative process requiring input from the patient, dentist, and ceramist.

Figure 1: Full-face preoperative view of the patient's dentition.

Introduction

The armamentarium of restorative materials available today help make dental procedures faster, easier, and more predictable but can also be somewhat bewildering. Often designed with specific characteristics useful for particular modalities—whether superior esthetics for anterior dentition, strength and durability for posteriors, ease of use, or any myriad of advanced properties—each material has its advantages and disadvantages. Producing esthetically pleasing and predictable restorations is a creative process requiring input from the patient, dentist, and ceramist.

While the roles of the patient and dentist are a given, inclusion of the ceramist during treatment planning can sometimes be overlooked. Dentists should rely on laboratory technicians and ceramists for their knowledge and expertise as important members of the interdisciplinary team. Trained to combine artistic skill with their knowledge of material handling properties, tooth anatomy, stains, glazes, and substrates,[1-3] laboratory ceramists specialize in recreating tooth color, form, and function according to the patient's and dentist's desired specifications.[3-5] Simultaneously, they are fabricating long-lasting, functional, and lifelike restorations indistinguishable from natural dentition. [1,2,3]

In many cosmetic cases, there will be more than one material and technique suitable for treatment. For instance, conservative smile makeovers with worn and/or misshapen dentition could be treated with porcelain laminate veneers created from feldspathic porcelain layering techniques or with a pressable ceramic using the cut-back technique.[6-10] An assessment of patient expectations, esthetics, tooth position, color, shape, angulation, and substrate, as well as functional considerations and occlusal relationships, all help dictate the appropriate material and procedure.[6-10] The importance of communication between dentist and ceramist becomes apparent when the number of factors affecting achievement of a successful restoration are considered.

Also to be considered are the experience levels of the dentist and ceramist. It may be advisable for a less experienced dentist to collaborate with an experienced laboratory partner. Together, a design plan is created to maximize material selection and technique, deliver the patient's anticipated results, and ensure the predictability of the restorative outcomes.[11,12]

Case Presentation

A 29-year-old female presented with crowding of the anterior teeth and rotation of the central incisors, which she felt were too square **(Figs 1-3)**. She presented with an uneven gum line, and her smile did not represent the desired Golden Proportion. The comprehensive examination revealed an overall healthy dentition with excellent periodontal health, a stable occlusion, and no presence of decay. However, in addition to the rotated and crowded teeth, the patient had slightly worn anterior central incisors; an old, stained, and worn composite resin restoration on the facial of tooth #10; and a deficient buccal corridor. She also presented with flat incisal edges on the cuspids that gave a worn appearance, and teeth #6 and #7 were longer than their contralateral counterparts **(Fig 4)**. Dissatisfied with her condition, the patient desired a brighter and whiter smile with straight, slightly longer teeth, and a "fuller" appearance.

Treatment Planning

The possibility of orthodontics was discussed with the patient as an option, but she wanted longer, whiter teeth with a different shape. Therefore, porcelain veneers were the treatment of choice for teeth ##3-14 and ##19-30. The goal was to improve the proportions, rotations, and length. To achieve proper gingival symmetry, a gingivectomy was required on teeth ##7-10 (WaterLase YSGG hard/soft tissue laser, Biolase Technology; Irvine, CA) **(Fig 5)**.

To minimize the patient's travel between Miami, where she lived, and our office in Northern Virginia, a wax-up was not prepared in advance. Therefore, as the patient wanted a slightly lengthened dentition, a resin mock-up was performed intraorally to determine the proper length, width, and general proportions of the new smile. The patient was left unanesthetized to evaluate her overall smile, as well as the length of her teeth with her upper lip at rest. Details of the design were noted and included as part of the laboratory prescription.

However, to better visualize teeth proportions and determine central incisor length and width, bulk reduction of proximal line angles of the central incisors was completed prior to the composite mock-up **(Fig 6)**. The patient chose treatment up to and including the first molars to avoid a noticeable shade difference in her smile. Slice preparations between the central and lateral incisors were necessary to straighten

Figures 2 & 3: Preoperative 1:2 views showing overlapping, crowding, and rotation of the short central incisors.

Figure 4: Preoperative 1:2 retracted view of the gingival asymmetry in ##7-10.

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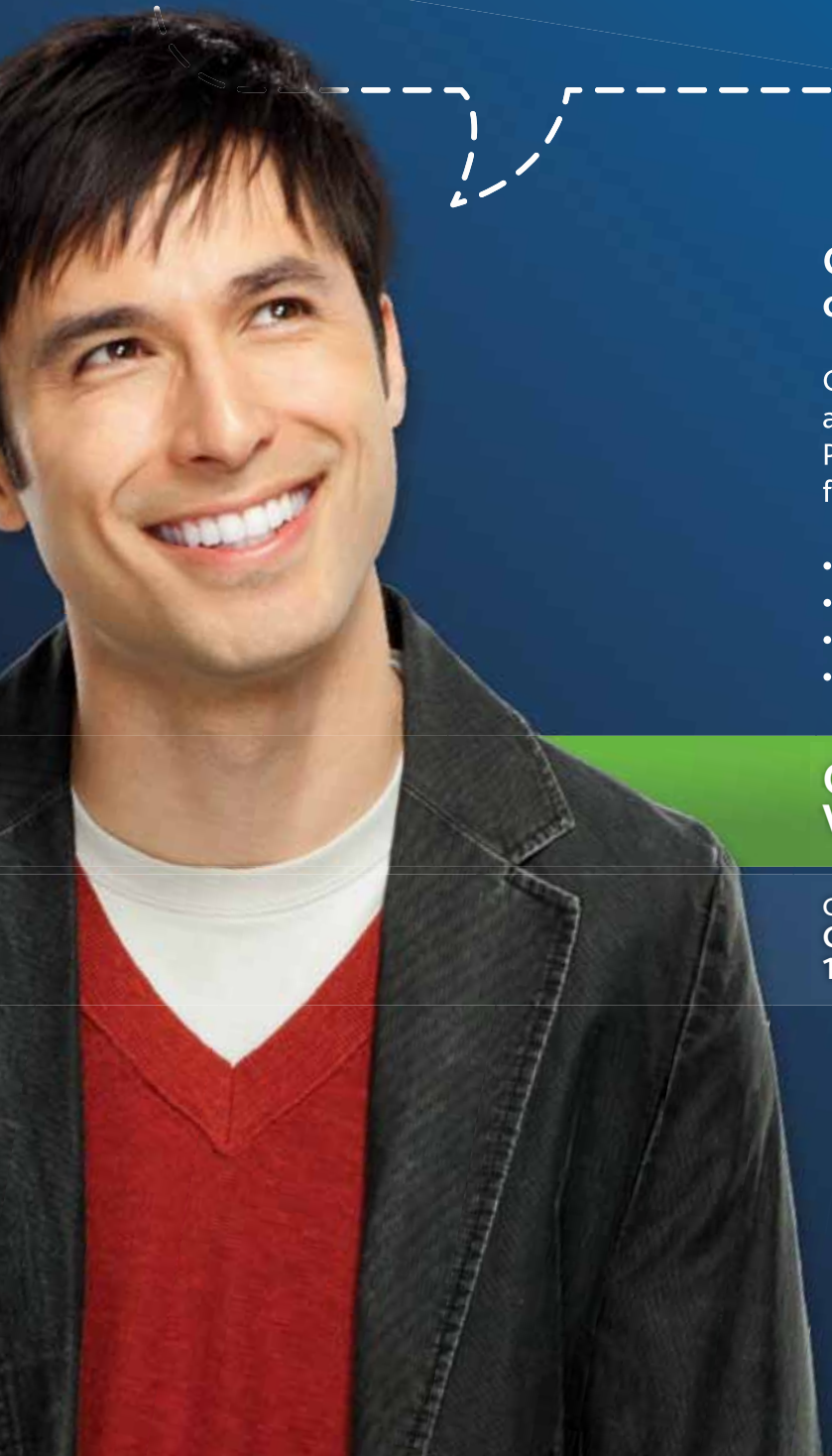

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Figure 5: Gingival recontouring was performed using a hard/soft tissue laser to achieve proper gingival heights and zenith.

Figure 6: Bulk reduction of the proximal line angles of the central incisors was performed to better visualize teeth proportions prior to the intraoral composite mock-up and to determine the appropriate central incisor length and width.

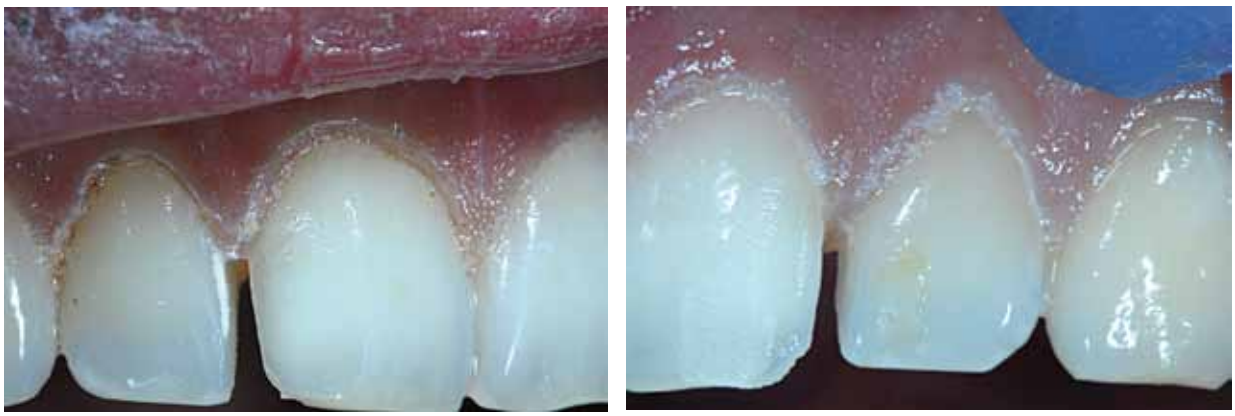
the central incisors, eliminating both overlap and crowding while simultaneously creating the proper spacing and height-to-width ratio required for the ceramist to produce the desired Golden Proportions **(Figs 7 & 8)**. Minimal preparation was required on the premolars and molars.

To attain the desired difference in length between the incisal edges of the central and lateral incisors, a measurement was taken and included with the laboratory instructions. Adding porcelain to the facial aspect of the premolars would increase the buccal corridor; therefore, the proper information was relayed to the ceramist.

Material Selection

Due to the generally conservative nature of the restorations, several available materials were suitable for use. The feldspathic porcelain layering technique and the cut-back technique using pressable ceramic (IPS Empress, Ivoclar Vivadent; Amherst, NY) were both options. However, high-translucency lithium disilicate (IPS e.max HT)—using the cut-back and layering technique—was the material of choice primarily due to its translucent optical properties and material strength. Featuring a relatively low refractive index, lithium disilicate mimics the light transmission observed in natural dentition[13-17] and provides a distinct advantage in translucency over other materials, particularly opaque zirconia.[17]

Produced with varied optical properties (i.e., high opacity [HO], medium opacity [MO], low translucency [LT], and high translucency [HT]), lithium disilicate ingots display true-to-nature properties and exceptional esthetics, making it ideal for this case due to the patient's preparation shade of A1/B1.[13-17] Darker teeth would have shown through the translucent lithium disilicate material.



Figures 7 & 8: Slice preparations between ##7-10 were required to create proper spacing and achieve Golden Proportions.

Figure 9: Provisional restorations were created from the preoperative dentition because a prior wax-up had not been created.

Strength-wise, lithium disilicate contains approximately 70% by volume needle-like crystals in a glassy matrix[13,14] and is uniquely designed with a controlled size, shape, and density to demonstrate greater strength and durability.[13-15]

After considering all factors involved, the interdisciplinary team agreed to create 24 IPS e.max HT veneers for teeth ##3-14 and ##19-30. To attain optimal esthetics, an OM2.5/OM3 blend (Vita 3D-Master Shade Guide, Vident; Brea, CA), medium translucency in both volume and intensity, with a light to medium texture, was chosen for the final shade.

Provisionals

As previously mentioned, an intraoral composite diagnostic mock-up was prepared in place of a pre-fabricated wax-up to minimize the patient's trips between Florida and Virginia. An impression was made of her existing dentition to use as a matrix for her provisional restorations once her preparations and final impressions were completed **(Fig 9)**. Prior to placing the provisional restorations, a symmetry bite was taken to verify midline and avoid canting, and a photograph of this in place was sent to the laboratory, along with a photograph of the preparation shade.

A bleach shade was selected for the provisional restorations, which were placed with a resin-based temporary luting material (Telio CS, Ivoclar Vivadent), which was chosen for its high translucency to ensure esthetic results as well as its adhesive properties.[18] As an important step in the treatment process, the provisionals enabled the patient to maintain function and esthetics while protecting exposed surfaces. They also allowed her to preview the planned final restorations and suggest changes in esthetics, size, shape, etc. Serving the dentist as a diagnostic tool, provisionals provide the clinician with an opportunity to evaluate the proposed esthetic design and function before fabricating the final restorations.[18]

Occlusal adjustments were completed, and the provisional restorations were finished utilizing a selection of fine diamond burs, followed with a finishing cup (Enhance, Dentsply; Milford, DE). A thin layer of provisional glaze (BisCover, Bisco; Schaumburg, IL) was brushed onto the restorations, after which they were light-cured. The patient was given home care instructions and provided with an electric toothbrush (Philips Sonicare, Philips Oral Healthcare; Snoqualmie, WA) to maintain optimal tissue health.

Laboratory Protocol

It is imperative for dentists to effectively communicate to the ceramist what the patient wants to accomplish. The dentist and his or her laboratory colleague then collaborate on how best to meet the patient's esthetic expectations while delivering optimal function and longevity.[12] Pre-preparation aspects of the dentition, including mathematical measurements needed to attain the proper proportions, number of teeth involved, preparation design, functionality, and materials all need to be considered by both dentist and ceramist.[19] In this case, detailed instructions relayed to the laboratory included material selection, width-to-length ratios of central incisors, shade selection, value, tooth morphology, surface texture, cervical/body preparation shades, and incisal translucency (volume and intensity).

Photographs are an essential communication tool to be included with the laboratory prescription and should include preoperative, preparation, and preparation shade views. An incisal view of the teeth in occlusion is also beneficial for verifying the mounting of the case. To ensure precision mounting on the articulator and prevent canting and midline discrepancies, a symmetry bite should also be included **(Fig 10)**. Such detailed instructions serve as a "recipe" to enable the ceramist to apply his or her skills and expertise in the fabrication of long-lasting, functional, and esthetic restorations.

In this particular case, due to the patient's distant residence, a review of the final wax-up was preferred for evaluating the smile design and making any final changes before pressing **(Fig 11)**. The case was then returned to the laboratory with a detailed request to shorten the laterals slightly and round off the distal incisal corners of the upper central incisors.

Working with IPS e.max ingots HT BL3, the ceramist cut back from the incisal third onto the labial surface and layered the fabrications with porcelain powder (IPS e.max Ceram) **(Figs 12-15)**. The case was then fired in a Programat P500 oven and mounted on a Stratos articulator (both Ivoclar Vivadent).

As the cervical part of prepared teeth is naturally warmer, and because the veneer was thin, some natural color would show through the translucent veneer. Therefore, preparation shade A1/B1, similar to the ND2 shade referenced in the IPS

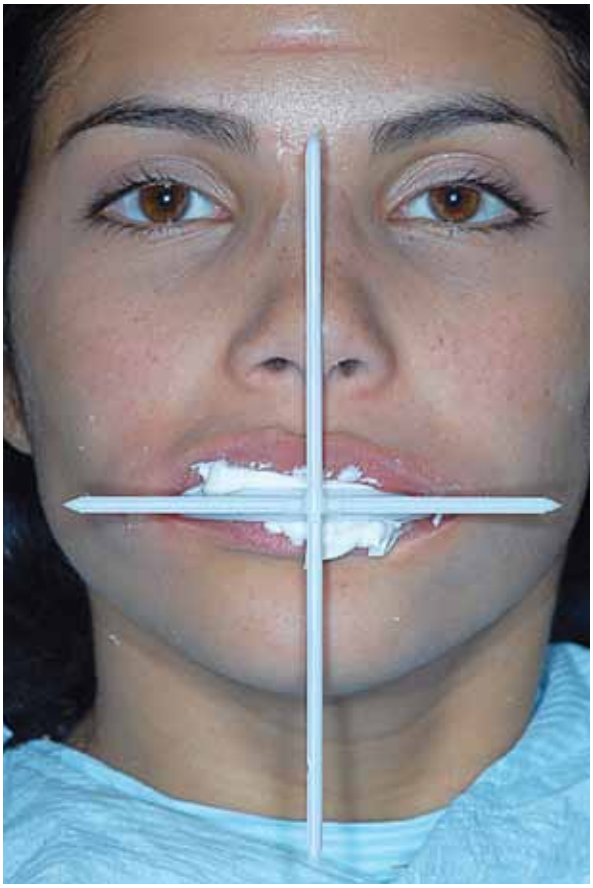


Figure 10: A symmetry bite was taken and sent to the laboratory with a photograph to verify midline and cant.

Figure 11: The dentist performed a review of the final wax-up prior to pressing to ensure that it represented his and the patient's desires.

Figure 12: View of the full-contour lithium disilicate veneers prior to cutback.

Natural Die Material Shade Guide, was chosen to obtain a seamless match. When layering was complete, the veneers were treated with a 9% hydrofluoric acid etch (Porcelain Etch, Ultradent; South Jordan, UT) to prepare them for cementation.

Cementation

Upon return from the laboratory, the veneers were placed on the model to verify proper fit. The patient was anesthetized and the provisional restorations removed. The teeth were cleaned with a pumice and peroxide slurry, followed by a chlorhexidine gluconate disinfecting scrub (Consepsis, Ultradent) before the veneers were tried in to evaluate fit and esthetics.

Once the patient approved her smile makeover, the restorations were removed, cleaned with 37% phosphoric acid (Ultradent) and rinsed. The veneers were then treated with a primer (Silane Primer, Kerr; Orange, CA) and set aside.

To complete the adhesive protocol, the teeth were treated with a 37% phosphoric acid etch for the required 15 seconds, then rinsed. A thin layer of Excite bonding resin (Ivoclar Vivadent) was applied to the etched teeth and light-cured for 10 seconds. The restorations were bonded with a light-cured resin luting cement (Variolink Veneer Cement, Ivoclar Vivadent) in shade +1. No catalyst was used. After initial cleanup, a Cerisaw (Denmat; Santa Maria, CA) was used to remove residual cement interproximally, and a sharp sickle scaler was utilized to eliminate excess cement from the margins.

Occlusion was verified using articulating paper (Accufilm, Parkell; Edgewood, NY) with a light coat of petroleum jelly applied to prevent the recorded ink marks from being erased by saliva. To evaluate excursive movements, the patient was asked to chew on rope wax on one side, with the articulating paper placed on the opposite side. The procedure was performed for both sides. Evaluated in this fashion,

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It may be advisable for a less experienced dentist to collaborate with an experienced laboratory partner.

Figures 13-15: The cutback allowed for internal incisal staining and layering of the porcelain powder (e.max Ceram).

occlusion was observed during a true chewing cycle to eliminate any excursive interferences. This was especially important in this patient's case to prevent tenderness and potential fractures caused by occlusal interferences.

A fine, football-shaped diamond was used to smooth the lingual surface, followed with an Enhance finishing cup to avoid leaving a discernible margin. The next day, the patient's occlusion was reevaluated to guarantee proper fit and function and eliminate any discomfort. Postoperative photographs were also taken **(Figs 16-18)**.

Conclusion

Clear and direct communication between the dental team, laboratory personnel, and the patient is essential in order to routinely and predictably achieve consistent esthetic results.[20] Laboratory ceramists are specially trained as skillful artisans to conceive and construct dental restorations with the goal of satisfying the expectations of both dentist and patient.[20] Dentists rely upon their laboratory colleagues' knowledge of dental anatomy and function, coupled with a mastery of materials and their handling properties, to translate their meticulous clinical and esthetic parameters into functional and esthetically pleasing restorations. Ceramists, due to their skills in combining the above with artistic creativity and their ability to foresee superior esthetic results, are an indispensable and integral part of the dental team.[21,22]

Acknowledgment

The author thanks the patient in this case for entrusting him to complete her beautiful smile makeover and for her willingness to travel from Florida to Virginia to complete the case. He also thanks Ryan Chung (Golden Vertical Ceramics; Oakton, VA) for his talent and attention to detail.

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Figures 16-18: Postoperative views of the final restorations show a natural-looking, beautiful, and harmonious smile.

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Disclosure: The author did not report any disclosures.

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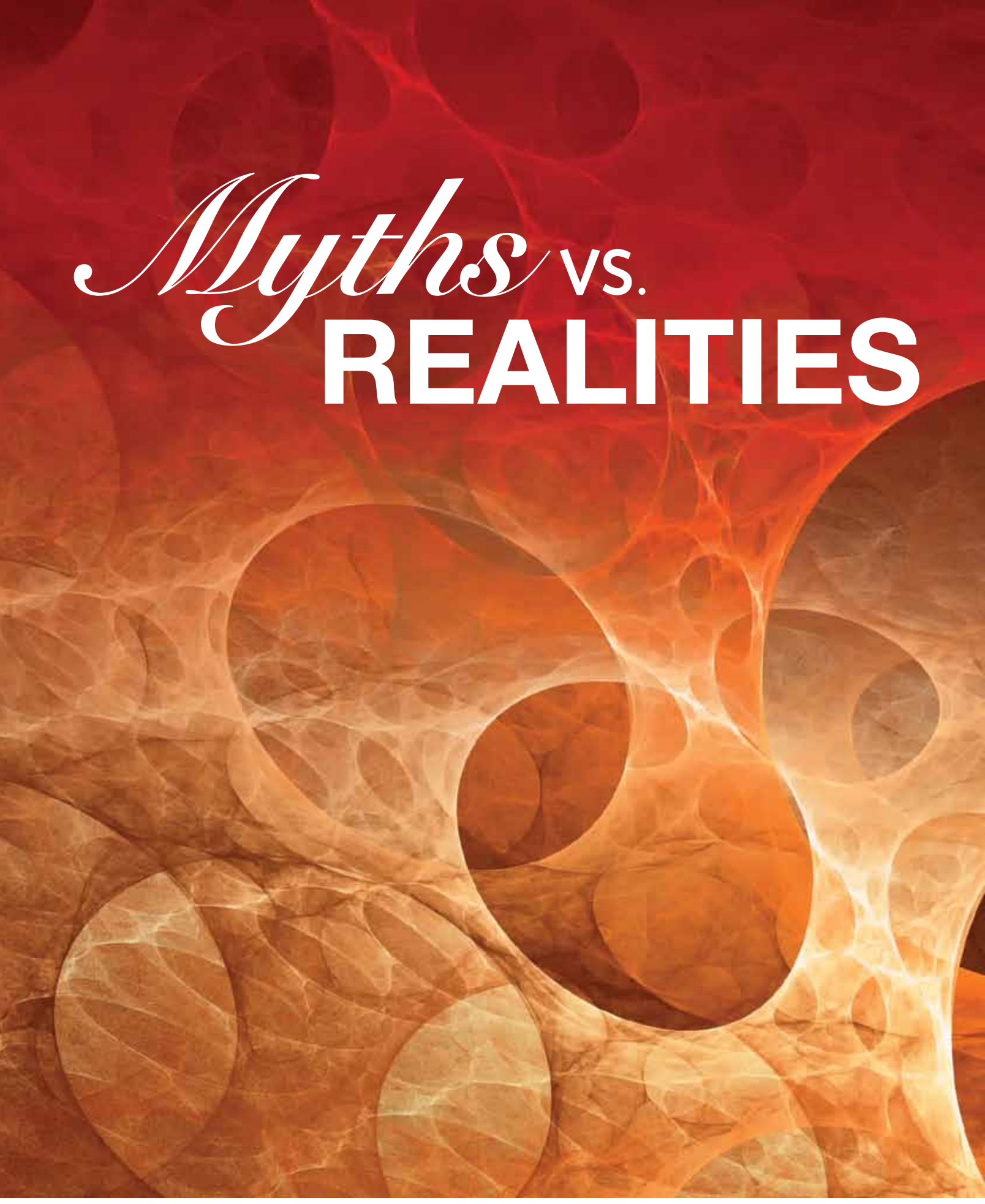
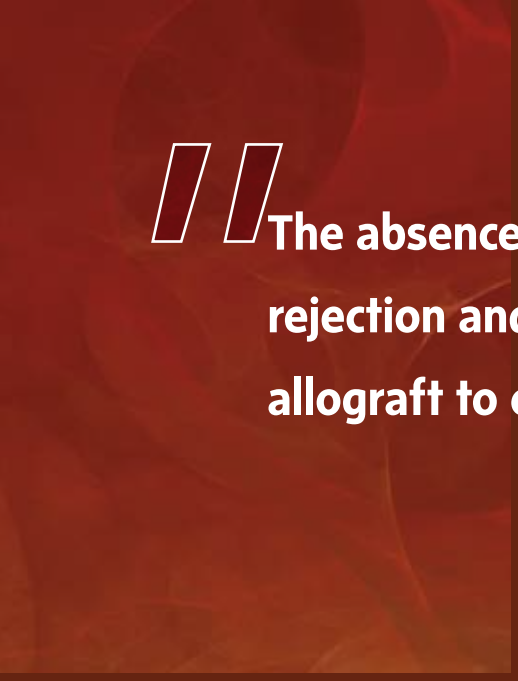

Myths vs.
REALITIES

ROOT COVERAGE GRAFTING

Edward P. Allen, DDS, PhD
W. Peter Nordland, DMD, MS

As options for treatment planning continue to increase, it is critical for clinicians to stay on top of the ever-changing techniques. It is important for us to recognize the dynamics of grafting for root coverage and the options available in order to make a more educated referral to a periodontist when necessary. The *jCD* asked two well-respected educators in the field to share their perspectives and experiences in regard to common myths and realities about such procedures. We are pleased to present in this Myths vs. Realities section, Drs. Edward P. Allen and Peter Nordland, who discuss important reasons why soft tissue grafting is the new reality.



"The absence of blood and cells prevents graft rejection and also eliminates the capacity of this allograft to carry pathogens."

Dr. Allen's Experience Using AlloDerm for Root Coverage Grafting

Gingival recession presents both an esthetic and a functional concern for patients. With current techniques, coverage of exposed roots can be achieved predictably provided there is no loss of interdental bone or soft tissue.[1] Connective tissue grafts, introduced in the 1980s, are considered to be the "gold standard" for treatment of gingival recession. However, this procedure requires harvesting palatal donor tissue, and in spite of significant refinements in surgical techniques, many patients remain fearful of palatal surgery and resist recommendations for treatment of root exposure and gingival deficiencies. Additionally, there may be inadequate palatal tissue volume as well as anatomical or medical concerns that rule out this area as an acceptable donor source. For these reasons, a substitute for palatal donor tissue is desirable.

AlloDerm (LifeCell, Branchburg, VA), an acellular dermal graft introduced in 1994 for treatment of burn patients, has been demonstrated to be an effective alternative to palatal connective tissue for root coverage grafting. In producing AlloDerm from donated human skin, all blood and cells are completely removed without damaging the connective tissue matrix. The absence of blood and cells prevents graft rejection and also eliminates the capacity of this allograft to carry pathogens. The remaining undisturbed fibrous matrix of natural biological components enables the recipient to mount its own tissue regeneration process.

Myths and Realities

Myth
All acellular dermal grafts are the same.

Reality
AlloDerm is considered the industry standard allograft for soft tissue grafting. Numerous studies, including case series, randomized controlled clinical trials, systematic reviews, and meta-analyses published over the past 17 years document the clinical and histologic efficacy of AlloDerm in root coverage procedures.[2-13] These studies demonstrate root coverage and gain in tissue thickness equivalent to palatal connective tissue grafts. Thus, AlloDerm has a long history of documented success in both medical and dental applications.

Other acellular dermal allografts have become available more recently. Puros Dermis (Zimmer Dental; Carlsbad, CA), introduced in the United States and Canada in 2006, is derived from human skin and undergoes a process of chemical extraction that includes immersion in 1N sodium hydroxide at room temperature for one hour followed by solvent dehydration. The result is a denatured collagen matrix. Additional acellular dermal allografts, such as PerioDerm Acellular Dermis (Dentsply Tulsa Dental Specialites; Tulsa, OK), processed by the Musculoskeletal Transplant Foundation, have been introduced within the past year, most with little to no evidence to support their efficacy in root coverage procedures. While all of these allografts are acellular dermal grafts, their processing methods vary considerably, resulting in different tissue components, different structural integrity, and inconsistency in removal of nuclear fragments. These differences, a result of different proprietary processing methods, result in a potential immune response leading to rejection and varying levels of cytokine production; this can cause resorption or encapsulation of the graft rather than tissue integration as has been demonstrated with AlloDerm.[14] More recently, xenogenic products derived from porcine tissues, such as DynaMatrix (Keystone Dental; Burlington, MA) and Mucograft (Osteohealth; Shirley, NY) have entered the market. These products are resorbable collagen membranes with, in this author's experience, inferior handling characteristics; and to date there is little to no evidence supporting the efficacy of these allograft substitutes for root coverage grafting.

Myth
Palatal connective tissue grafts gain more keratinized gingiva than AlloDerm.

Reality
Gain of keratinized gingiva is an outcome parameter appropriately applied to a surface graft such as a free gingival graft. Gain of keratinized tissue serves as a measure of graft survival and success of that procedure. Current root coverage grafting techniques utilize a coronally advanced flap to partially or completely cover the graft, whether it is palatal connective tissue or AlloDerm. With this technique, most or all of the graft is submerged beneath the original marginal tissue, thereby reducing graft exposure and improving graft survival over root surfaces. Only the portion of the graft left exposed at surgery, or exposed secondarily by retraction of the overlying flap, will result in a gain of keratinized tissue.

Figure 1a: Gingival recession and absence of attached gingiva facial to a maxillary canine with a shallow cervical notch in the exposed root.

Figure 1b: Optimal esthetics and complete root coverage maintained five years after AlloDerm grafting using the tunneling technique.

Thus, gain of keratinized tissue is not reflective of survival or success of submerged grafts. Studies of submerged grafts, both palatal connective tissue and AlloDerm, show a gain of only 1 to 2 mm of keratinized tissue, with no difference between the two graft types.[2-9,15-17] There is a greater gain of dense, stable connective tissue beneath the overlying flap than indicated by the nature of the surface with both graft types.[4] While the overlying tissue masks the graft, it allows for a perfect match of the grafted site with adjacent sites, thereby providing optimal esthetics **(Figs 1a & 1b)**.

Figure 2a: Miller Class III gingival recession involving four mandibular posterior teeth. The marginal tissue is thin and there is minimal keratinized tissue.

Figure 2b: A thick, wide zone of functional tissue and nearly complete root coverage maintained six years after AlloDerm grafting.

Myth

AlloDerm has limited applications.

Reality

There is a misperception that AlloDerm may not be used in sites with less than 2 to 3 mm of keratinized tissue, and that it is less successful in the mandibular arch, particularly the mandibular anterior region. Actually, all root coverage procedures perform better in the presence of 2 to 3 mm of keratinized tissue, and the mandibular anterior area often presents additional complications of aberrant frenal attachment and reduced vestibular depth.

Root exposure is commonly associated with a deficiency of gingival thickness and width, thus an important objective of root coverage grafting is to enhance the thickness and width of marginal functional tissue **(Figs 2a & 2b)**. As described above, the current technique of totally submerging the graft beneath coronally advanced existing tissue masks the gain of dense functional collagenous connective tissue below the surface. While the submerged graft procedures result in better esthetics than surface grafts, they result in a minimal gain of keratinized tissue. This characteristic is attributable to the technique rather than to the graft material. A totally submerged palatal connective tissue graft, like a totally submerged AlloDerm graft, results in a minimal gain of keratinized tissue. While this surface appearance is pleasing to the patient, it is disturbing to dentists accustomed to seeing the distinct surface change typical of partially or completely exposed grafts.

AlloDerm grafts used for root coverage perform best when completely or almost completely covered by coronally advanced existing tissue **(Figs 3a-3c)**. When more than 1 mm of AlloDerm is left exposed over a root during a root coverage procedure, it is subject to loss.[18] A palatal connective tissue graft can survive with up to a 3-mm exposure over a root.[19] In some sites, particularly the mandibular anterior region, it may be difficult to passively advance and stabilize existing tissue over a graft, leading to excessive graft exposure. This may account for the impression that AlloDerm cannot be used in this region. However, use of a tunneling technique rather than a flap technique for recipient site preparation allows for both passive advancement and control of retraction. The tunneling technique is the preferred recipient site preparation method for either an autograft or an allograft, and it may be used successfully in the presence of an aberrant frenum and/or a shallow vestibule **(Figs 4a-4c)**.

Figure 3a: Severe recession and lack of attached gingiva facial to multiple teeth in the maxillary arch. Cervical lesions are present with minimal involvement of the enamel.

Figure 3b: An AlloDerm graft was placed in a tunnel and the overlying tissue and graft were simultaneously advanced coronally to the cemento-enamel junction with a single continuous sling suture. A minimal amount of the graft remained exposed.

Figure 3c: Eight months after surgery, complete root coverage has been achieved. The enamel defects at the canine and premolar may be restored if desired.

Figure 4a: Shallow recession and absence of attached gingiva facial to the mandibular left central incisor, and thin attached gingiva facial to the right central incisor, complicated by an aberrant frenal attachment and shallow vestibule.

Figure 4b: Two weeks after AlloDerm grafting with the tunnel technique, there is minimal swelling and redness, with re-establishment of a normal vestibular form.

Figure 4c: Thickened marginal tissue, absence of a frenal pull, and normal vestibular depth maintained two years after AlloDerm grafting surgery.

Myth
AlloDerm is too technique-sensitive.

Reality
A more accurate way to state this point is to say that AlloDerm is less forgiving than palatal tissue. AlloDerm performs best when completely covered in root coverage applications. Early graft exposure due to flap retraction leads to greater postoperative problems with AlloDerm than with palatal connective tissue. Thus, the surgical technique must be more precise with AlloDerm than with palatal tissue to achieve good outcomes.

This need for precision has led to the development of a minimally invasive surgical grafting technique that is more stable and heals faster than the traditional open flap procedures. The best recipient site preparation technique for AlloDerm is the tunnel technique, which effectively controls retraction and prevents graft exposure. Special microsurgical instruments, including an Allen end-cutting intrasulcular knife, Allen microsurgical elevators, and an Allen-modified Orban knife (all Hu-Friedy; Chicago, IL) have been developed to facilitate the performance of this technique.

Conclusion
Use of AlloDerm means there is no need to harvest a graft from the palate, a procedure that itself can be technique-sensitive and result in complications. The handling characteristics of AlloDerm are superior to palatal connective tissue, and multiple teeth and sites can be treated in a single visit with AlloDerm. When using the proper instruments and the tunneling technique, root coverage grafting with AlloDerm is actually easier to perform than root coverage grafting with palatal tissue. Following training in the technique, many general dentists with surgical experience routinely perform successful root coverage grafting with AlloDerm **(Figs 5a & 5b)**. Patient acceptance of treatment is higher due to the ability to correct unsightly root exposure without the need to harvest tissue from the palate and without the need for multiple surgical visits when multiple teeth need treatment.

Figure 5a: Vigorous tooth brushing in the presence of a thin periodontium resulted in Miller Class III recession with no attached gingiva facial to the mandibular incisors. (*Image courtesy of Dr. Elizabeth Bakeman, Grand Rapids, MI.*)

Figure 5b: A thick zone of immobile tissue with nearly complete root coverage 17 months after grafting with AlloDerm. (*Surgery by Dr. Elizabeth Bakeman, Grand Rapids, MI.*)

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Dr. Allen is founder and director of the Center for Advanced Dental Education in Dallas, Texas, where he teaches surgical technique courses. He has a private periodontics practice in Dallas.

Disclosure: Dr. Allen is a consultant for and receives honoraria from BioHorizons, the distributor of AlloDerm. He also is a consultant and has developed products for Hu-Friedy. He does not receive any royalties from the sale of any products discussed in this article.

"In the past it was thought that soft tissue could not be restored once it was lost and that if it was restored, a periodontal pocket might develop."

Dr. Nordland's View on Why Connective Tissue Grafting for Root Coverage is Still Considered the "Gold Standard"

Just as cosmetic restorative dentistry has undergone significant changes in the past 20 years, so has the specialty of periodontics. Periodontal plastic surgery has become a great friend to cosmetic restorative dentists, with its ability to predictably raise or lower gingival contours to meet the restorative demands to create entirely new framing of smiles. In the past it was thought that soft tissue could not be restored once it was lost and that if it was restored, a periodontal pocket might develop. Root coverage grafting has been mistakenly thought to be painful, unpredictable and unesthetic.

Myths and Realities

Myth

Connective tissue grafts are not predictable.

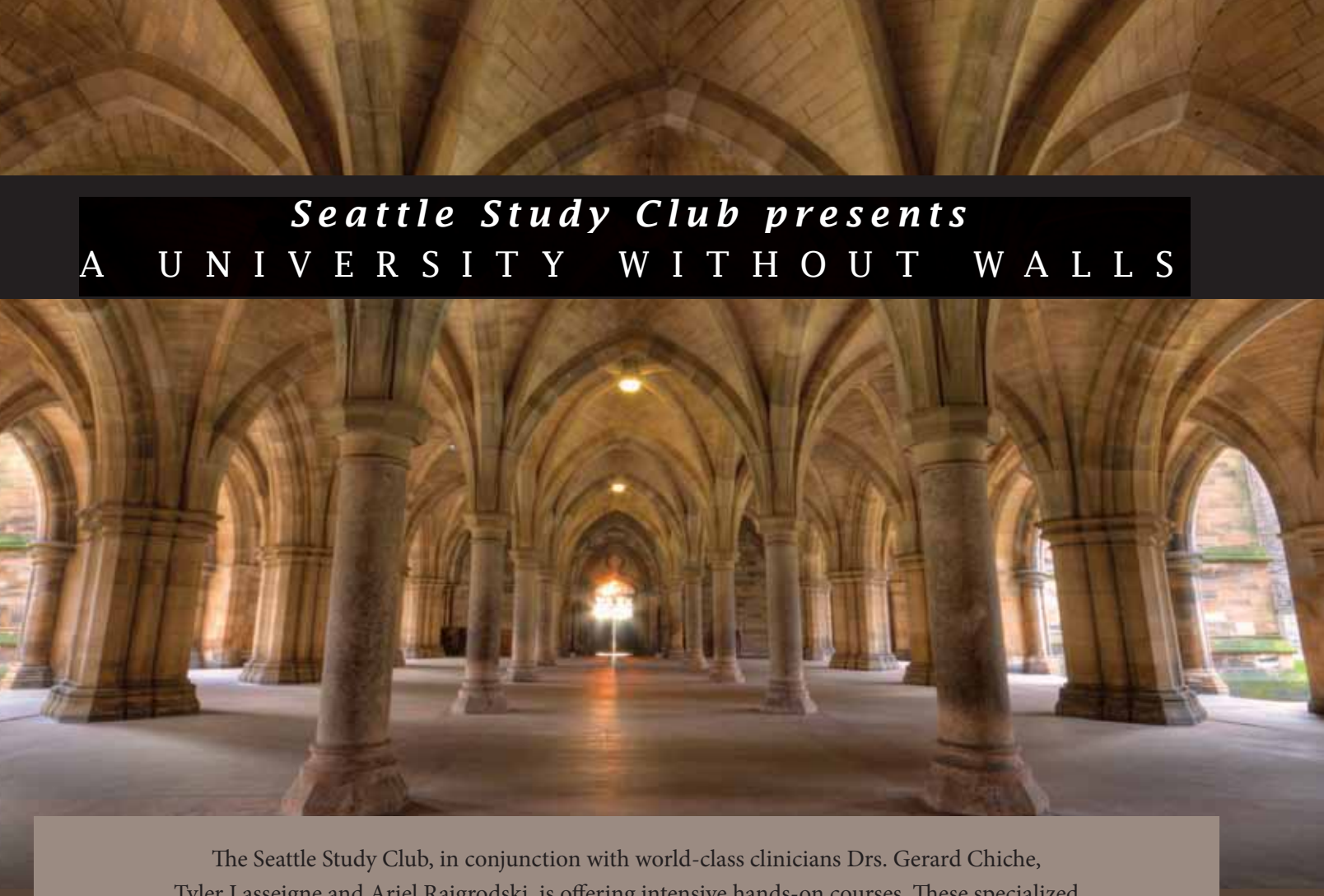
Reality

Connective tissue grafts are predictable today, and for several reasons. First, because the success of tissue grafting is dependent upon the availability of a blood supply, earlier experiences have led to the belief that tissue grafting is not a predictable procedure. This author believes, however, that they are successful today due to advances in procedures and techniques. In the past, when a surface graft was placed upon the donor bed, 30% of tissue cells were in contact with a vascular supply; thicker grafts increased that to 40%. Later, surface grafts were replaced with subepithelial connective tissue grafts, making it possible to "sandwich" the donor tissue into the recipient site, increasing the blood supply to 80%. Now, with the advent of the modified tunnel technique, the graft vascularity is increased to nearly 100%.

In the 1980s, the treatment of gingival recession evolved from mucogingival surgery into periodontal plastic surgery.[1-3] A variety of techniques were used to produce root coverage in areas of gingival recession, including placing the graft directly on the denuded root, and utilizing free gingival grafts alone or combined with a coronally positioned flap.[1,4] Increased success of these grafts was due to the double blood supply resulting from the connective tissue base and the overlying recipient flap.[5] The donor site remains a closed wound, producing little postoperative discomfort. The modified tunnel technique provides a larger supply of blood vessels surrounding the graft cells, thereby increasing predictability of the connective tissue graft.[6,7]

The advancement of microsurgery has also contributed to the success of connective tissue grafts with the advent of microsurgical instruments.[8,9] Microscopic vision and microsuturing techniques allow for non-traumatic wound closure and accelerated healing.[10] The surgical microscope provides increased illumination and visual acuity to perform tissue grafts with superior precision.[9,10] Microsurgical instruments decrease trauma, pain, healing duration, postoperative morbidity, and visible scarring while increasing predictability and providing superior cosmetic results **(Figs 1-4)**.[8,10]

Figures 1-4: Severe recession with root abrasion for teeth #5, #6, #27, and #28 was conservatively treated with connective tissue grafts.



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> **...connective tissue grafting for root coverage can help the cosmetic restorative dentist achieve a better and longer-lasting outcome.**

Myth
If roots are covered with grafted tissue, a pocket will result.

Reality
Research in the 1980s showed that new connective tissue attachment to a previously diseased root surface was possible using acid demineralization of the root during the surgical procedure. The goal was to expose collagen of the root, promote new cementum formation, and recreate a functional attachment of collagen fibers back to the root.[11] It followed that if new attachment to a root surface was shown to be possible, then incorporation of these concepts could allow for root coverage procedures to cover roots without creating a periodontal pocket.

After that original regeneration research, numerous articles have appeared in the literature detailing techniques to incorporate demineralization with root coverage grafting.[1-3,12] It has also been shown that gingival grafting tissue regeneration procedures can be used to cover previously carious roots and be as predictable as treatment of intact roots.[13] Periodontal root coverage should now be considered a viable alternative to Class V restorations for better esthetics, predictability, and longevity.

Myth
Tissue grafting or augmentation is a painful procedure.

Reality
The old free gingival grafts were indeed painful at the donor site, where an open wound exposed nerve endings and severed blood vessels. With today's procedures, connective tissue grafting is not painful. As previously mentioned, microsurgery diminishes postoperative pain and discomfort. Less pain and rapid healing is attributed to the dramatically reduced incision size made with a scalpel less than 1 mm wide.[4,8,10,13] In the past, a conventionally sized scalpel was used to remove tissue from the roof of the mouth. The healing process was extensive because it healed in from the sides. Now, tissue is harvested from beneath the surface, resulting in a minimally traumatic, closed wound.[2] Minimizing the wound accelerates healing and reduces pain.[13,14] Many times surgeons fabricate a palatal stent, similar to a retainer but without wires, to help protect the palatal donor site so that the donor site is not disturbed by the tongue or food.

The author performed a pain study on 100 consecutively treated patients who ranked their pain immediately after multiple tissue grafts. On a scale of one to 10 (one indicating no pain and 10 signifying maximum pain) the average score was 1.8, characterizing the procedure as nearly painless.

Myth
A Class V restoration can be a good treatment option for recession.

Reality
Although cervical lesions are commonly treated using restorative materials, esthetics and durability of the restoration can be problematic. Clinically, it has never been shown that Class V restorations can prevent recession; on the contrary, they might promote bacterial accumulation and exhibit microleakage.

Unfortunately, clinical observations suggest that the bond efficacy to root structure is questionable. Weak adhesion can allow bacteria to undermine the restoration. Unabated bacterial colonization can lead to root caries, halitosis, and cervical sensitivity. Often, retentive grooves and undercuts are made that require preparing the tooth, thereby making the procedure invasive and irreversible.

Numerous laboratory studies have reported that the initial bond of resin to dentin degrades substantially over time.[15-19] Even with the most effective adhesives, bonding of resin-based restorations in the cervical area can be compromised by sclerotic dentin, which is commonly present and less receptive to bonding than normal dentin.[20] Paolantonio has shown that Class V restorative materials can have a negative effect on the bacterial flora, causing a shift in flora toward gram negative anerobes.[21]

Some investigators working with dentinal bond strengths suggest that a periodontist should be consulted before placement of restorative materials on the roots, to assess the potential for future use of gingival grafts for root coverage **(Figs 5-7)**.[22]

After root surface caries is removed, the exposed root presents with a similar clinical challenge to noncarious root surfaces for root coverage grafting and the treatment is equally predictable.[14] Modern gingival augmentation techniques can offer predictability in root coverage, regeneration of attachment, and esthetics.[2]

Figures 5-7: This patient presented with deep recession and root caries. Postoperative images show six-week and three-year results.

Successful root coverage grafting has been well documented.[23,24] According to Winter and Allen,[25] restorations of cervical lesions should be avoided, thus circumventing the dilemma of restoring the pathologic dentin. Periodontal root coverage procedures are the preferred method of treatment because of the high predictability for complete root coverage. The outcome of current procedures using a connective tissue graft or an acellular dermal matrix graft is highly esthetic and the surgical site is often undetectable.[25]

The need for, and usefulness of, root surface restorations is minimal because current alternatives are available not only to restore the lost gingivae but also to protect the root from sensitivity and caries while providing a natural-looking esthetic result. Because root coverage grafting has proven to be predictable, the benefits of replacing the missing tissue with gingivae should be considered a treatment option when recession exists. Along with soft tissue root coverage, cervical sensitivity, exposure for risk of root caries, esthetics, and longevity are associated with soft tissue grafting. In this author's experience, once a protective band of attached keratinized tissue is created, future recession or breakdown should be eliminated or greatly reduced **(Figs 8 & 9)**.

Figure 8: Preoperative view shows dark, undermined Class V restorations.

Figure 9: Postoperative view shows healing once composite was removed and connective tissue grafts were placed.

Conclusion

The use of connective tissue grafting for root coverage is considered the "gold standard." Allogenic tissues could be considered as a second option when palatal tissue is unavailable or when a patient has a problem with hemostasis. Connective tissue grafts are predictable, essentially painless, can create new attachment to a previously diseased root surface, and can be considered an alternative to Class V restorations. Dentists should consider root coverage procedures even when the root surface is carious. Because root coverage is predictable, virtually painless, and creates an ideal framing of the smile **(Figs 10 & 11)**, connective tissue grafting for root coverage can help the cosmetic restorative dentist achieve a better and longer-lasting outcome.

Figure 10: Tooth #27 had a failing composite root filling, 7 mm of root exposure, and another 4-mm cleft, for a total of 11 mm of recession.

Figure 11: Following removal of the old restoration, a connective tissue graft was performed, providing coverage and protection without a deep pocket.

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Disclosure: The author did not report any disclosures.

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20 TIPS

When You Refer, What Does Your Specialist Need from You?

Are you giving your specialists the critical information they need when you refer a patient to them? In the spirit of interdisciplinary collaboration—and with the ultimate goal of improving patient care—the *jCD* asked respected clinicians and educators in the field, representing five different specialties (periodontics, prosthodontics, oral surgery, orthodontics, and endodontics), to provide readers with tips about what they need most from their referring general practitioners. You will find in the next few pages a total of 20 tips that will help you develop a better relationship with the specialists to whom you refer your patients.

THE SPECIALISTS

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Disclosure: The author did not report any disclosures.

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Disclosure: The author did report any disclosures relevant to the content of this article.

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Disclosure: The author did not report any disclosures.

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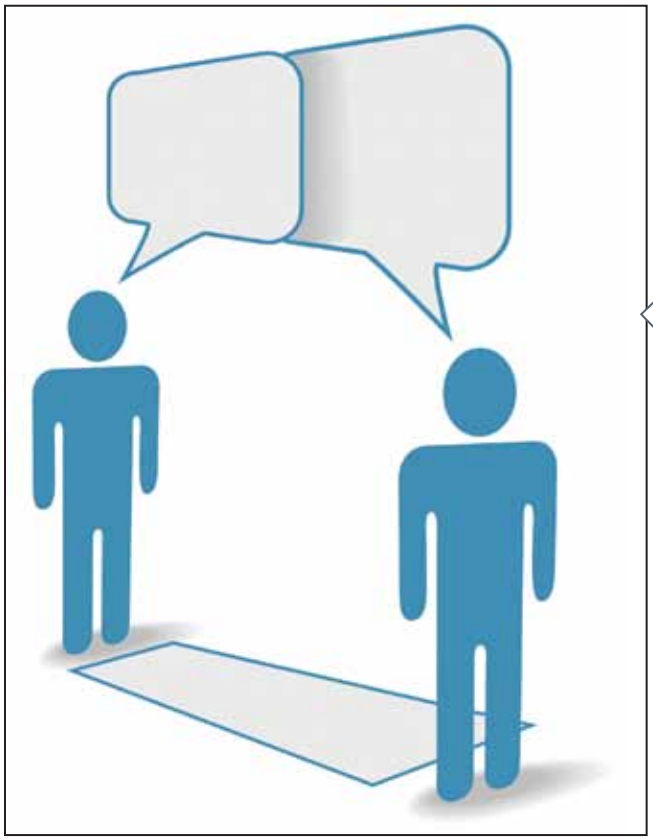
Disclosure: The author did not report any disclosures relevant to the content of this article.

Tips from a Periodontist

by Dan Holtzclaw, DDS, MS

Do not become complacent—once the communication lines have been established, keep them open!

Periodontics has a very intimate relationship with restorative dentistry. In many cases, one cannot function properly without the other. Communication is one of the most critical factors in the dentist-periodontist referral process. Although time-consuming and sometimes cumbersome, open lines of communication are one of the most important facets of my practice. All too often, the communication I receive from referring dentists is a simple one-sentence explanation of what they want. The tips below will help to improve communication with your periodontist and thereby help to improve patient outcomes.



1. Consider communicating to your periodontist by sending them a letter that fully explains your treatment plan. All too often, the communication I receive from referring dentists is a simple one-sentence statement of what they want. For example, a letter may simply say, "Evaluate maxillary anterior teeth" or "Crown lengthen #19." While this does provide some very basic information, it leaves much to be desired and often results in the periodontist needing to assume certain things the referring provider wants. A detailed letter explaining your plan will provide a much higher level of communication and better explain your desires. Provide as much detail as you can, otherwise you may end up with a completely different result from what you envision. Whether it is by letter, e-mail, fax, or phone, communicate!

2. Send us images! Most of you take images of your patient; please share them with your referring specialist. It will help us envision where you are and where you want to be. E-mails also provide the ability to send attachments such as photographs and diagrams. Most cosmetic dentists have computer programs that manipulate photos to show a patient prospective "before and after" images for certain treatments. Both clinical and simulated images are helpful. It is simple, effective, and visual...a great combination.

3. If at all possible, have a face-to-face meeting. This type of communication is very effective in that dentist and specialist can share ideas, evaluate radiographs together, handle models, etc. In terms of sheer effectiveness, this is probably the best manner of communication. However, meeting face to face is often difficult in light of the busy schedules most providers maintain. Try to make time.

4. Avoid failures. Periodontists and restorative dentists have an intimate relationship. In many cases, we cannot function without each other. A fixed partial denture placed on teeth with moderate to severe periodontal disease is often doomed to fail. Communicating with your periodontist could avoid this. No matter which form of communication you settle upon, the important thing is to not allow the communication process to break down. Do not become complacent—once the communication lines have been established, keep them open!

Editor's Note: For more detailed information about communicating with your periodontist, see Dr. Holtzclaw's article, "Periodontal Referral Tips for Cosmetic Dentists," on page 90.

See Page 90

Periodontal Referral Tips Full Article

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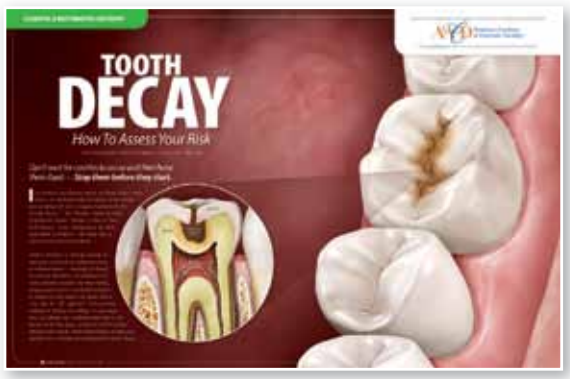

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Tips from a Prosthodontist

by Ernesto A. Lee, DMD, DCD

Specialists are the general dentist's partners in the delivery of interdisciplinary care, and prosthodontists are no exception.

A study conducted by the American College of Prosthodontists[1] revealed that only 9% of the general dentists surveyed referred to prosthodontists, compared to 69% that refer to oral surgeons, 63% to endodontists, 44% to periodontists, and 26% to orthodontists. The primary reason for not referring patients to prosthodontists was that 70% of general dentists said that they do the work themselves. There are certain cases however, that are better managed when referred to a prosthodontist. Although referrals often are made on the basis of case complexity, additional consideration should be given to factors such as patient expectations, potential liability, and the efficiency of delivering prosthodontic therapy within a general practice model.

Specialists are the general dentist's partners in the delivery of interdisciplinary care, and prosthodontists are no exception. Following are considerations to help optimize prosthodontic referrals.

Figure 1

Figure 2

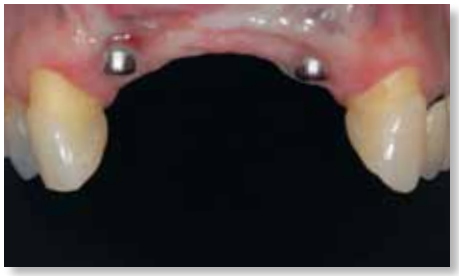

Figure 3

1. Do not attempt to take additional diagnostic records for the sake of the referral. The reality is that most specialists have their own standards when it comes to diagnostic records, and mutual emphasis should be made to avoid redundant procedures and charges to the patient.

2. Patient education is perhaps the most important contribution to the referral process. By making sure the patient understands the reasons why they are being referred, you will become their advocate. Invest some time in explaining the scope and potential costs associated with prosthodontic therapy. Even if patients opt not to pursue it, you will still be perceived as a knowledgeable and caring practitioner.

3. Treat the types of cases that are within your level of comfort. Although the dental laboratory may assist in navigating through a difficult situation, by law (at least in the U.S.), technicians follow instructions from the dentist, therefore making you solely responsible for the outcome. Patients exhibiting certain risk factors are best referred to a prosthodontist. These risk factors include parafunctional habits **(Fig 1)**, occlusal disharmonies, inadequate vertical dimension **(Fig 2)**, complex implant reconstructions **(Fig 3)**, and patients with high esthetic demands. Your referral is based on your scope of practice, and is not a reflection of knowledge or technical ability. If a prosthodontist makes you feel otherwise, then refer elsewhere.

4. Referrals should be made as soon as possible. However (except for emergency procedures), treatment should not begin until a prosthodontic treatment plan has been developed. Co-treatment arrangements can then be made; this may avoid saving teeth subsequently deemed nonrestorable, or the premature extraction of teeth that could be utilized to support an interim prosthesis. Situations where the patient is referred with temporary restorations following completion of crowns or bridges should be avoided.

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Tips from an Oral Surgeon

by Joel L. Rosenlicht, DMD

When referring a patient to your oral surgeon, there are many details for you to keep in mind beyond the usual (e.g., sending x-rays, referral notes, and the patient's health history). The following tips highlight ways in which you can aid the oral surgeon(s) to whom you refer your patients.

1. Recognize that, many times, having an abundance of tissue is advantageous and once the soft tissue has healed, manipulating the tissue to maximize esthetics can enhance the final restoration. Discuss with the surgeon in advance the exact procedure that is going to be done in conjunction with either soft tissue augmentation at the time or separate from implant placement so that maximum healing and augmentation of the soft tissue can take place. This should be followed by the development of the site with either an ovate pontic, or the reduction of soft tissue with burs or lasers to form the central portion of the emerging crown.

Discuss with patients all their options prior to the removal of their teeth.

2. Teeth often are removed by a variety of practitioners and the future plan for the restoration may or may not be discussed. Discuss with patients all their options prior to the removal of their teeth. If a final decision cannot be made at that time, consider socket grafting so that options in the future can be preserved. By maintaining the established ridge, either a fixed conventional prosthesis and/or implants can be placed into that site. Socket grafting, also known as ridge preservation, involves placing bone graft material into the socket immediately following tooth extraction. Healing will remodel the graft over time to maintain the maximum amount of both hard and soft tissue in these situations.

3. Discuss, when impacted teeth such as canines, bicuspids, or even second molars need to be exposed for orthodontic traction for proper position, whether "Wilckodontics" (selectively performing monocortical corticotomies adjacent to teeth in conjunction with full orthodontic treatment) is a possibility. This could be done in conjunction with the exposure of the crowns of those teeth, as it does sometimes appear to significantly facilitate the movement in these very challenging orthodontic cases.

4. Congenitally missing teeth often have overlying deciduous teeth. This appears to be beneficial for the patient in order to maintain space and develop a good occlusion. The potential for ankylosis or the migration over submerged deciduous teeth needs to be considered. If any deciduous teeth appear to be submergent or ankylosed in bone, they must be removed at the earliest possible opportunity.

Tidbit

Many times, having an abundance of tissue is advantageous.

Tips from an Orthodontist

by David M. Sarver, DMD, MS

Communicate with the orthodontist your new approach to space allotment.

How many times have you stopped in the middle of a procedure, slapped your forehead, and wondered, "Why am I doing it this way?" Usually it is because we were taught that way, or it is the way everyone does it, or the way we have always done it.

This case addresses the orthodontic preparation of the patient with an undersized or peg-shaped maxillary lateral incisor. For many years, when placing my orthodontic appliances, I would place a bracket on the undersized lateral, and used active coil springs to position the tooth between the canine and central **(Fig 1)**, going back and forth as my dental colleague instructed me, "I need it 1/4 mm to the mesial." This often was followed at the next visit by the directive, "No, now 1/8 mm back to the distal!" It was very frustrating.

Figure 1: In preparation for the restoration of an undersized lateral incisor, or to make space for emergence profile in cases of attrition, needed space may be orthodontically created.

Figure 2a: The patient had excellent incisor display, transverse smile dimension, and consonant smile arc.

Figure 2b: She had a deep bite with a midline diastema and small maxillary lateral incisors.

1. Do not bother with the lateral until ample space has been prepared around it; then have the lateral temporarily restored to ideal dimensions—the size and shape desired for the final restoration. The orthodontist simply places the lateral bracket as he or she would for any lateral incisor. This way, ideal placement is relatively straightforward and much more accurate, theoretically delivering to the dentist a tooth in an ideal restorative position.

In my assessment of the functional and esthetic goals of treatment for this case I noted that the smile arc was consonant[1] and incisor display excellent **(Fig 2a)**. The teeth were generally spaced **(Fig 2b)**, with incomplete passive eruption[2-5] on the lateral incisors and the canines unerupted.

Communicate with the orthodontist your new approach to space allotment. If possible, the undersized tooth should be temporized to ideal dimension before orthodontic appliances are even placed

2. I recommend simple composite bonding material, which is easily manipulated and modifiable during treatment, and a relatively good material on which to adhere an orthodontic bracket.

Encourage the orthodontist to keep a periodontal probe in the office (the orthodontist may actually have a diode laser in the office for use in these types of cases).[6-7]

After initial orthodontic alignment, extra space was created on the mesial and distal aspects of the lateral, and the lateral intruded to attain better vertical gingival relations **(Fig 3)**. I recommend that the orthodontist create more room than needed so the temporary can be made to ideal dimension.

The lateral incisor bracket was removed so that excess gingival tissue could be removed with a diode laser so the height-to-width ratio could be visualized **(Fig 4)**.

3. The lateral was then temporized to ideal size and contour **(Fig 5)** and the lateral bracket was placed in order to finalize tooth position and close the remaining space **(Fig 6)**. Orthodontic treatment was finished and the provisional restorations were replaced with the final, more esthetic restorations and a beautiful smile **(Figs 7a-7c)**.

4. Ideally, you should be sure to see the patient for final approval before orthodontic appliances are removed.

Figure 3: The laterals were intruded orthodontically and extra space was created for ideal tooth dimension for the temporary restoration.

Figure 7a: Final occlusal and restorative result.

Figure 4: The bracket was removed and a diode laser used to remove excess gingival tissue.

Figure 7b: Final smile.

Figure 5: The lateral was bonded to the appropriate dimension.

Figure 7c: Final full-face smile.

Figure 6: The bracket was placed to ideal position and closure of the remaining space was begun.

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Tidbit

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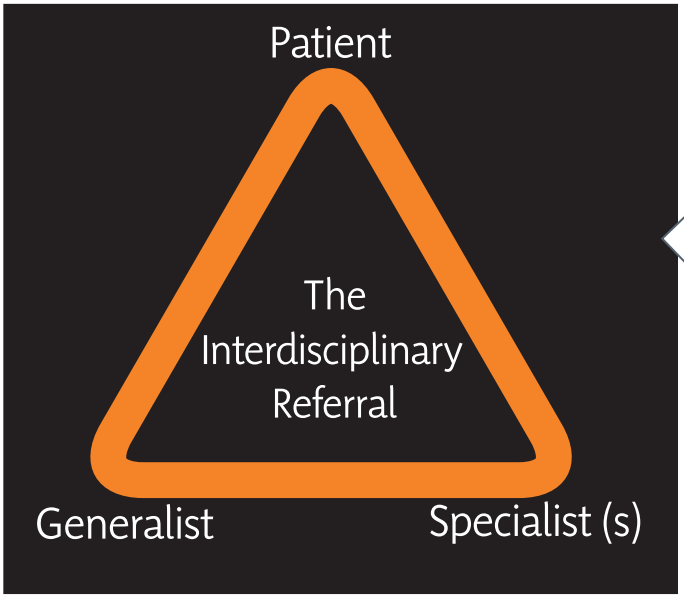
Remember, while there is only one diagnosis, there may be several treatment plans.

Tips from an Endodontist

by John D. West, DDS, MSD

The most favorable interdisciplinary dental outcomes often occur when a trusted team treatment plans together in order to solve complex challenges. This "what do you do with this?" exchange enables the dentist to deliver responsible and successful treatment options. Collaborative dentistry requires impartiality, planning, and proper sequencing while presenting the patient with the optimal and alternative treatment plans. Remember, while there is only one diagnosis, there may be several treatment plans. The tips below will get you started in the right direction with your endodontist, patient, and team when the next challenging endodontic patient presents in your practice.



1. Trust and responsibility are critical. The patient has granted trust to the restorative dentist. In the referral to the endodontist, the dentist must accept responsibility for a successful referral and must recognize the profound nature of that transfer of patient trust to the endodontist. The dentist must inform the endodontist about the patient's "dental IQ" and dental values so that the endodontist can purposefully affirm and support the treatment plan.[1,2]

2. Equality and confidence are vital. The referring dentist must not be fearful of exposing treatment inadequacies to the endodontist. Do not be afraid that the endodontist might believe they have more knowledge in a particular discipline. Remember, the endodontist knows a great deal about a very specific subject. The general dentist is the treatment "quarterback" and understands the big picture.[3,4]

3. Teamwork and leadership are key. The general dentist knows the patient best and is responsible for teaching the endodontist[2] the preferred treatment sequence, expectations, and outcomes. None of these responsibilities can nor should be delegated. Sit down with your endodontist, share your practice philosophy, and learn how he or she can support your purpose. Have a two-way conversation before the referral process ever happens and learn what each of you needs and wants in order to produce a successful referral for patient, dentist, and endodontist.[5]

4. Determine whether endodontics or implants are more appropriate. Any endodontically diseased tooth can and should be saved if the root canal system can be sealed either nonsurgically or surgically, if the tooth is periodontally sound or can be made so[5] and the tooth is restorable (i.e., 4 mm of 1-mm thick ferrule from height of bone to height of ferrule), and if doing so does not compromise dental esthetics. This is an objective and measureable treatment plan thought process. The best way to decide how to advise the patient about their choice is to think, "What would I do if it were me?" No one member of the interdisciplinary team should make a unilateral decision about endodontics versus implants unless the best interests of the patient are carefully evaluated by all relevant dental disciplines.[6-8]

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TIPS FOR COSMETIC DENTISTS WHEN REFERRING TO A PERIODONTIST

Communication is Key

by Dan Holtzclaw, DDS, MS

Tidbit

Open lines of communication are among the most important facets of my practice.

As a specialist in the field of periodontics, I communicate with other dentists on a daily basis. For every patient I see, whether it is a simple exam or the most complex surgery, I generate a communication letter to the referring provider. Frankly, this is one of the most time-consuming aspects of my practice (as it is for many other periodontists I know). Not only are we generating notes in the patient's chart, but we are also generating a communication letter: double the work, double the effort, double the time. Although time-consuming and cumbersome, open lines of communication are among the most important facets of my practice. In fact, communication is recognized as one of the most crucial factors influencing the periodontal referral process. A study recently published in the *Journal of Periodontology*[1] ranked the importance of various factors in the periodontal referral process according to both periodontists and general practitioners. While the results of the study found that each group had different opinions as to what the most important factors were, both groups ranked quality communication in the top three critical factors of the general practitioner-periodontist referral process.

Periodontics is closely interrelated with restorative dentistry. In many cases, one cannot function properly without the other. A fixed partial denture placed on teeth with moderate to severe periodontal disease is often doomed to failure, just as a house built upon a poor foundation is going to crumble. While this seems fairly self-explanatory, one of the situations I see most frequently in cosmetic dentistry is veneers being placed on teeth that should have had crown lengthening prior to restorative treatment. Often, the patient has spent tens of thousands of dollars on a matching set of porcelain restorations, only to have them chronically irritate the gingivae. In addition to causing perpetually red, bleeding, and puffy gums, these restorations commonly are too short and out of proportion. Situations like this can be avoided by improved communication between the cosmetic dentist and the periodontist.

Once you have established a relationship with your periodontist, you will mutually discover the most effective form of communication that works best for both of you.

The Critical Nature of Communication

A cosmetic dentist is essentially acting as a specialist with a practice scope limited to cosmetic restorations. As such, consider communicating to the dentists to whom you refer by sending them a letter fully explaining your plan. All too often, referring dentists send me a simple one-sentence explanation of what they want. For example, a letter may only say, "Evaluate maxillary anterior teeth" or "Crown lengthen #19." While this does provide some very basic information, it leaves much to be desired. A detailed letter explaining your plan will serve much better to explain your goals and the patient's desires. For example, instead of writing "Evaluate maxillary anterior teeth," something like the following would be far more helpful: "I plan to place porcelain veneers on teeth ##5-12. Please evaluate maxillary anterior to see if crown lengthening is needed prior to restoration placement. If so, please let me know how much additional tooth will be exposed following surgery." The more detail, the better. I was a general dentist for many years prior to becoming a periodontist, so I approach all of my patients from a general dentist's point of view. Unfortunately, many periodontists go straight from dental school to periodontal training and have never actually practiced "real world" restorative dentistry. If you do not provide detailed instructions to such providers, they may approach the case from a periodontal point of view rather than a restorative point of view. If this happens, and you have poor communication with one another, your end goals may be completely different.

- If you feel that a letter may not adequately express your needs, a phone call can also be a great way to communicate to your periodontist. This method of communication allows for a quick back-and-forth that may result in an exchange of ideas not achievable with a letter. Phone calls are fast and easy, and the simple act of speaking to one another adds a personal touch to the communication. The only problem with phone calls is that you can often end up playing "phone tag," without being able to reach one another in a timely manner.

- E-mail is another excellent means of communication. More and more, I am finding this to be the most efficient way to communicate with a referring provider. Like phone calls, e-mails are quick and easy, but, because they can be read anytime, e-mails eliminate the "phone tag" problem of not being able to reach one another. E-mails also enable you to send attachments such as photographs and diagrams. Most cosmetic dentists have computer programs that manipulate images to show a patient the prospective "before and after" results for certain treatments. Why not include these images in the communication to your referring provider? You use these images to help your patients to accept treatment; use them to help communicate your vision to the periodontist as well.

- Finally, another way in which some providers communicate is by having a face-to-face meeting. Dentists and periodontists can share ideas, evaluate radiographs together, handle models, etc. This is probably the most effective manner of communication, but it is also likely the most difficult to achieve, owing to both parties' busy schedules.

- Once you have established a relationship with your periodontist, you will mutually discover the most effective form of communication that works best for both of you. Sometimes it may be a combination of everything mentioned above. No matter which method you choose, the important thing to remember is to not allow the communication process to break down. Over time, one can sometimes become complacent and fall into a rut. Do not allow this to happen—keep the lines of communication open!

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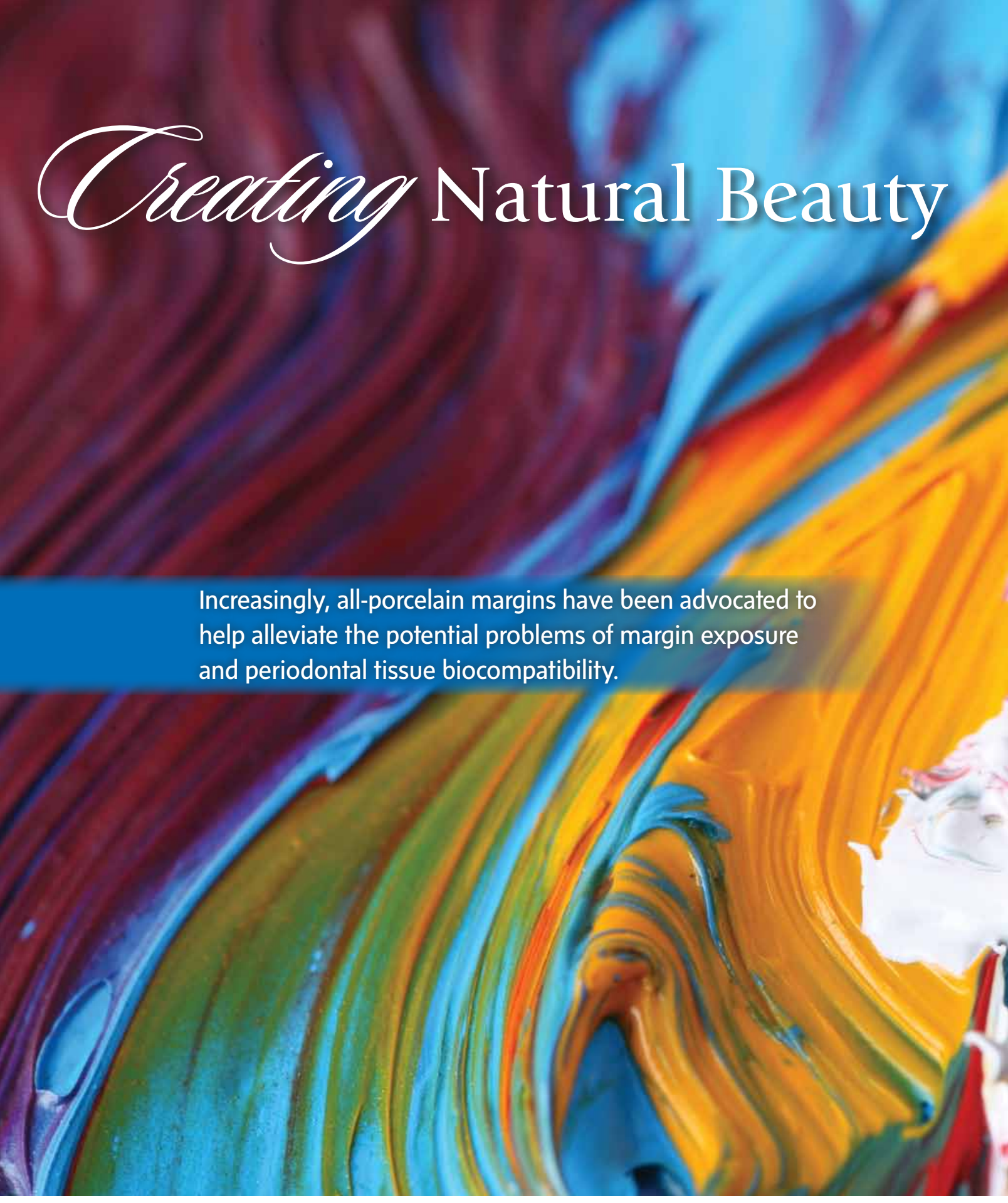
Disclosure: The author did not report any disclosures.

Creating Natural Beauty



Increasingly, all-porcelain margins have been advocated to help alleviate the potential problems of margin exposure and periodontal tissue biocompatibility.

with Zirconia Restorations

A Technical Approach to Esthetic Excellence

Sang K. Jun, CDT
Norm Rosene, DDS

Abstract

In their quest for perfection, dentists seek stronger, longer-lasting, and more esthetic materials. While porcelain-fused-to-metal (PFM) has been the "go-to" material for years, dentists are finding the characteristics of high-strength, all-ceramic materials more suitable for durable and esthetic restorations. All materials have advantages and drawbacks, including all-ceramic zirconia, which is growing in popularity. While addressing the characteristics of zirconia, the porcelain layering technique, and the role of thermal diffusivity when fabricating zirconia restorations, this article also discusses the ceramist's ability to achieve exceptional esthetics with zirconia restorations by understanding and controlling varying levels of optical properties to meet multifarious demands.

Figure 1: Fabrication of the customized zirconia abutment.

Introduction

When fabricating a restoration, whether it be anterior or posterior, strength and esthetics are two primary considerations. To satisfy both, many dentists have relied on porcelain-fused-to-metal (PFM) as their material of choice. However, it has proven difficult to fabricate long-term esthetic restorations utilizing PFM because they often lose their esthetic appearance with time, and covering the dark-colored metal coping proves challenging. Generally placed with subgingival margins, PFM restorations may contribute to recession of gingival tissues. The resulting exposure of the crown margin(s) often compromises the esthetics of the restoration.[1] Increasingly, all-porcelain margins have been advocated to help alleviate the potential problems of margin exposure and periodontal tissue biocompatibility.[2]

The quest for a durable material that transmits and refracts light like a natural tooth has led to various developments in restorative materials for esthetic restorative dentistry, including all-ceramic restorations.[3] Most dentists would agree that all-ceramic restorations provide the most esthetically pleasing results. However, the propensity for fracture and chipping in past and current materials has caused dentists to seek even stronger, more dependable yet still esthetically pleasing all-ceramic materials.[1] As an alternative, zirconia-based all-ceramic restorations with layered porcelain are becoming more widely used. Although approved for single crowns, fixed partial dentures, and implant abutments, zirconia too has proven to have some disadvantages.[4]

As a fairly new material compared to others on the market, there has been insufficient research and therefore a lack of education and understanding regarding its scientific properties, causing a number of failures along the way.[5] In a study by White and McLaren, zirconia was found to exhibit thermal diffusivity, heating faster and hotter and holding heat longer than other substructures.[6,7] Because zirconia heats at a different rate than porcelain, the layered porcelain may not bond properly to the zirconia coping. As a result, there is a greater chance of separation and, consequently, chipping and fractures of the porcelain veneer overlay.[4] White and McLaren demonstrated that during the porcelain firing cycle, utilizing a slower heating rate (41°C/minute) and then a slow-cool thermal cycle post firing minimized the residual stress at the porcelain/zirconia interface.[6,7] This firing protocol decreased the risk of failure to less than 6% for the porcelain overlay, and less than 1% for the zirconia core.[7] However, researchers and laboratory technicians are still conducting studies to determine the best way to prepare zirconia-based restorations, as the incidence of chipping and fracture is believed to result from the preparation method, not the material.[4]

Esthetically speaking, due to the nearly white color of zirconia, layering porcelain over zirconia presents less of a challenge than for PFM restorations. Pigmented zirconia copings can also be used.[1] If recession or age exposes zirconia margins, they are likely to be less objectionable when compared to conventional PFM margins.[1] Zirconia cores possess the capacity to mask a dark tooth preparation, but a minimum thickness of 0.5 mm is necessary to mask the dark stump shade. This requires ceramists to use proper veneering techniques to produce clinically acceptable, natural tooth-colored restorations.[8]

The artistic techniques and skills used by technicians and ceramists are of the utmost importance. For example, one study has demonstrated that with zirconia restorations, the type of veneering technique used by ceramists affected the transparency and translucency of the resulting restorations.[8] Another study indicated that different ceramic layer thicknesses significantly influence the final color of PFM restorations, thus affecting how closely restorations achieved the desired shade.[9] Additionally, other variables controlled by technicians and ceramists include ceramic condensation, thickness, temperature, and number of firing cycles, all of which also affect the esthetics and longevity of the final restorations.[10]

The artistic techniques and skills used by technicians and ceramists are of the utmost importance.

With zirconia, proper esthetics can be achieved by choosing stain or color with the least electromagnetic wave length, such as violet, to emphasize light diffusion and create the illusion of depth. Irregularly layering higher-opacity powder to reflect light from within, and blending or contrasting powders with different optical densities to refract or transmit light, creates the appearance of natural dentition. The porcelain layering procedure for layering zirconia restorations is similar to that of more conventional porcelain restorations.[11] The major difference is that when layering zirconia, the first layer should be fired at a hotter temperature than recommended by the manufacturer to perform as a bonding agent.[12]

The following describes a precise and artistic technique for fabricating an esthetic and natural-looking implant-supported zirconia restoration for the esthetic zone. When zirconia restorations are properly veneered, they can produce clinically excellent and highly esthetic results. Predictable color matching is possible, and the resulting restorations have the capacity to mask a dark background such as a dark tooth or core build-up material.[13]

Laboratory Protocol

Following creation of the customized zirconia abutment, the zirconia coping was seated on the abutment to check fit **(Figs 1 & 2)**.[14] The margin was cut back 0.5 mm to 1 mm to modify the gingival shade and match the adjacent teeth **(Fig 3)**.

The desired shade of porcelain margin materials was applied to the gingival third of the restoration and fired according to the manufacturer's recommended temperature **(Figs 4 & 5)**. The build-up technique was used to maximize esthetic results by layering one-half to a whole shade darker than the required shade **(Fig 6)**.[12]

Base dentin **(Fig 7)** and dentin porcelains were built up to full contour **(Fig 8)**. The dentin was cut back to suit the patient's age and the desired shape of the restoration **(Fig 9)**. To embody natural tooth effects, the internal aspects of the restoration were characterized, including the internal incisal edge effects referred to as mamelons **(Fig 10)**.[12] The appearance of the mamelons was created by feathering a thin, stain-like liquid along the incisal edge.[12]

Dentin was removed from the center of the restoration to create a high-value zone, often found in young teeth **(Fig 11)**, and replaced with bright enamel or whitish translucent dentin based on the desired effect **(Fig 12)**. The space between the dentin structures was then filled in with enamel to preserve the shape of the dentin structures **(Fig 13)**. The enamel layer was completed, creating the illusion of depth by utilizing different enamel effects and various optical density powders **(Figs 14 & 15)**.

To reflect the light outward, opacious dentin porcelain was layered roughly 1 mm above the tip of the coping on the palatal aspects of the restoration **(Fig 16)**, then covered with dentin **(Fig 17)**. Enamel porcelain was layered and marginal ridges created **(Fig 18)**. Dentin was removed from the gingival interproximal and replaced with orange-colored opacious dentin **(Fig 19)**.

After the first bake, adjustments were made as needed in the enamel/translucent layer **(Figs 20 & 21)**. The translucent layer was completed using a whitish translucent on the high-value zone, and bluish translucent on the mesial and distal incisal edges **(Fig 22)**. The restoration was fired a final time to create the lifelike esthetic result **(Figs 23 & 24)**.

Figure 2: Zirconia coping was seated on the abutment to assess fit.

Figure 3: Margin was cut back 0.5 mm to 1 mm to modify gingival shade and match adjacent teeth.

Figure 4: The appropriate shade of porcelain margin materials was applied.

Figure 5: The restoration was fired according to manufacturer recommendations.

Figure 6: Shade was built up using one-half or a whole shade darker than the required shade.

Figure 7: Base dentins were built up.

Figure 8: Dentin was built up to full contour.

Figure 9: Dentin was cut back according to desired shape and the patient's age.

Figure 10: Internal aspects of the tooth were characterized.

Figure 11: Dentin was removed from the center of the tooth.

Figure 12: Dentin was replaced with a bright or white translucent dentin.

Figure 13: Incisal edges were layered with enamel to preserve the shape of the dentin.

Figure 14: Enamel layer was built up.

Figure 15: Completed enamel layer.

Figure 16: Dentin was built up on the palatal aspects of the restoration.

Figure 17: Completed dentin layer.

Figure 18: Enamel skin layer was built up with marginal ridges and cingulum.

Figure 19: Dentin was removed from the interproximal gingival and replaced with orange-colored opacious dentin.

Figure 20: The restoration was fired.

Figure 21: Adjustments were made as needed in the enamel/translucent layer.

Figure 22: Whitish and bluish translucents, respectively, were applied to the high-value zone and on the mesial and distal incisal edges.

Figure 23: Completed translucent layer.

Figure 24: The restoration was fired a final time.

Conclusion

Although there are many factors that affect the esthetics and strength of all-ceramic restorations,[10,15] ultimately it is the precise and artistic technique for fabricating an esthetic and natural-looking implant-supported zirconia restoration that produces a clinically acceptable and highly esthetic result. Therefore, continuing education and effective communication enhance restorative longevity and esthetic excellence. Dentists and technicians must keep abreast of new techniques, understand the patient's needs and expectations, and agree upon the treatment plan. If, as in this case, an oral surgeon or other specialist is needed, interdisciplinary efforts can be combined to execute a successful, esthetic, and long-lasting restoration **(Figs 25-32)**.

Figures 25-30: Views of the final restorations.

Acknowledgment

The author thanks oral surgeon Dr. Mark Womack (Chico, CA) for his excellent implant surgery and placement.

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Figure 31: Postoperative right lateral view of restored maxillary central incisors.

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Figure 32: Postoperative full-face image.

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Disclosure: The authors did not report any disclosures.

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

1. Understand the physiologic changes in soft tissue and bone that take place following tooth loss, and combine orthodontic and surgical techniques and treatment sequencing to help achieve predictable success.
2. Understand the benefits of monitoring the actual progress of treatment compared to the original treatment goals, as well as utilizing a team approach and multiple treatment modalities to obtain an ideal result.
3. Recognize the possible benefits of "hopeless" teeth in the ideal treatment sequence for an excellent outcome.

ANTERIOR EXTRACTION & IMPLANT PLACEMENT IN A SEVERELY DEFICIENT SITE

Multidisciplinary Enhancement of Hard and Soft Tissue Profiles

Sergio Rubinstein, DDS
Maurice A. Salama, DMD
Henry Salama, DMD
David A. Garber, DMD
Mark B. Jacob, DDS

The digital version of this article features a webinar opportunity to learn more about this topic.

Abstract

Achieving optimal esthetic restorative results associated with anterior extraction and tooth replacement continues to be one of the most challenging endeavors in reconstructive cosmetic dentistry. When implant therapy is the treatment of choice, the margin for error is further decreased dramatically and methods to minimize and/or eliminate the potential for failure must be employed. This is especially relevant when the tooth to be extracted is associated with significant hard and soft tissue deficiencies. Assessing the patient's expectations, establishing a thorough diagnosis, and choosing the optimal therapeutic options to sequence and design treatment are key considerations for predictable success. Part 1 of this two-part article describes just such a clinical challenge related to the replacement of a severely compromised central incisor, with special emphasis placed on the utilization of pre-extraction orthodontic therapy to enhance the hard and soft tissue profile of the future implant receptor.

Figure 1: Image displaying the patient's high lip line. She also was unhappy with the cosmetic deformity related to her right central incisor.

Figure 2: Periapical of #7 and #8.

Introduction

Extraction and implant placement is a functionally predictable therapeutic modality. Esthetic predictability, however, can sometimes prove elusive. This is especially true for the implant replacement of severely compromised anterior teeth with hard and soft tissue deficiencies within the esthetic zone. For the exacting patient facing such circumstances, it becomes incumbent on the clinician to recognize the challenge(s) through a thorough diagnostic protocol and thereafter to choose the optimal therapeutic options for overcoming them. With so many documented therapeutic options for techniques and materials available to clinicians today for reconstructing hard and soft tissue deficiencies, making optimal choices depends very much on the patient's expectations and the specific nature of the site being reconstructed.

This article highlights the decision-making process for the successful replacement of a hopeless maxillary central incisor exhibiting significant deficiencies in a challenging esthetic environment. In addition, special focus is placed on the benefits of utilizing pre-extraction adjunctive orthodontic eruption therapy to optimize the hard and soft tissue of the potential implant recipient site.

Clinical Case

A 57-year-old female presented with a non-contributory medical history except for oral bisphosphonate therapy over a five-year period. The bisphosphonate therapy was discontinued just prior to seeking a dental consultation. The patient's chief complaint at her first appointment was a significant concern about the existing right central incisor, particularly related to the considerable recession, exposed root, and associated cosmetic deformity **(Fig 1)**.

An oral examination recorder generalized (+) mobility levels across her entire dentition except for the maxillary right central

In conjunction with the gingival recession and apicoectomy, the majority of the osseous labial plate of the right central incisor had resorbed.

incisor, which exhibited a Class II+ mobility. All posterior teeth presented with a balanced occlusion, a little localized recession, and a history of mild bone loss but were otherwise periodontally stable. The upper right lateral and central incisor had undergone endodontic therapy several years earlier, with the upper central incisor requiring a subsequent apicoectomy **(Fig 2)**.

In conjunction with the gingival recession and apicoectomy, the majority of the osseous labial plate of the right central incisor had resorbed. While the defect on the labial of #8 was significant, it was also localized. Important influencing considerations were the anatomy of the soft tissue defect, having a triangular shape, as well as the lack of any attached gingivae **(Fig 3)**.

Relevant Diagnostic Influences

Relevant diagnostic influences were as follows:

- high patient expectations
- high lip line
- gingival recession resulting in uneven gingival margins
- lack of attached gingivae, #8
- lack of labial plate of bone, #8
- lack of cosmetic smile parameters of balance, harmony, and continuity of form
- lack of shade match, #7.

Upon a thorough clinical evaluation, the lingual aspect of the crown showed aggressive occlusal adjustment on the porcelain and the metal substructure **(Fig 4)**.

Discussion

The interdisciplinary team evaluated all possible treatment options for addressing the patient's chief complaint and enhancing the smile display. Principal among them were regaining balance, harmony, and continuity of form within the esthetic zone. A major concern was the expected position of the interproximal papillae around the central incisor with the anticipated treatment modalities.

To accomplish this goal, reconstruction of the lost bone and soft tissue in the area of the right central incisor is a primary consideration. Myriad surgical techniques are available today that are capable of accomplishing this. To correct such an extensive defect, however, all surgical protocols would require a staged approach of multiple procedures involving both bone

Figure 3: Advanced gum recession of 9 mm with loss of the labial bone. No attached gingivae, with the surrounding tissue extremely inflamed and exhibiting bleeding upon probing.

Figure 4: There was a history of aggressive occlusal adjustment on the #8 crown.

Figure 5a: Labial view of the right central incisor without the PFM crown.

Figure 5b: Incisal view of teeth in occlusion. The gold post is touching the opposing incisor with no clearance for the final restoration.

Figure 5c: Adequate incisal clearance must be created for the orthodontic eruption of the root to be accomplished in the absence of occlusal trauma.

Figure 5d: Incisal view of the canal preparation, creating enough internal retention to prevent dislodgment of the provisional.

Figure 5e: Provisional restoration permanently cemented.

and soft tissue augmentation[1,2] with subsequent corrective procedures often required. A patient with a recent five-year history of bisphosphonate therapy would need to be cautioned about such an aggressive approach if a suitable option presented itself. A possible alternative, adjunctive orthodontic eruption, is often considered when the hopeless tooth in question retains a relatively intact apical fiber apparatus capable of influencing the surrounding tissue. This orthodontic therapeutic modality is well documented and has been utilized effectively to help correct restorative, periodontal as well as esthetic clinical challenges.[3-9]

The literature also validates that orthodontic eruption stimulates bone deposition at the crest as the tooth migrates coronally. In addition, it has also been widely demonstrated that coronal soft tissue enhancement and an increase in keratinized gingivae can also be predictably accomplished utilizing orthodontic eruption.[3,7,10] Therefore, whenever possible, the orthodontic solution is always considered right along with surgical options in the correction of hard and soft tissue defects. For this patient in particular, with a history of bisphosphonate therapy, it would also allow the team to more safely evaluate, along with appropriate blood tests, the clinical osseous response and metabolism prior to extraction or more involved surgical intervention such as bone and soft tissue grafting.

Sequence of Therapy

The porcelain-fused-to-metal (PFM) crown was removed to evaluate the remaining tooth structure, existing post, and tooth preparation **(Fig 5a)**. An incisal view showed the tooth/post structure had no lingual/incisal clearance with the opposing dentition, possibly leading to active occlusal trauma[11-14] and the mobility pattern evident at initial examination **(Fig 5b)**.

The lack of the lingual concave contour on the post did not allow for a proper anatomy on the final crown, which precluded the final restoration from functioning properly in a harmonic occlusal scheme either in centric occlusion or excursive movements. With caution, the post/tooth interface was opened with a thin diamond bur and, using an ultrasonic scaler, the post was removed and followed by significant tooth preparation to provide the necessary occlusal clearance of tooth/root structure. This allowed for enough clearance during orthodontic eruption **(Fig 5c)**.

The intaglio of the canal was prepared as well, to be a part of the provisional restoration and provide the required retention so that the temporary would not dislodge during orthodontic treatment. This retention was maximized by also permanently cementing it with a resin glass ionomer cement **(Fig 5d)**.

Utilizing a transparent index from a study model and wax-up, a direct technique provisional was fabricated utilizing a bis-acryl composite material. The anatomy of the central incisor was reproduced to match the contour of the adjacent central incisor **(Fig 5e)**.

Orthodontic Treatment

Any orthodontic intervention must be instituted only after inflammatory control has been accomplished. Therefore, oral hygiene instruction, scaling, and root-planing, as well as closed curettage, were performed prior to commencing orthodontic therapy. In addition, adequate retention is always necessary and often requires the inclusion of a minimum of two adjacent teeth, one on each side of the tooth being erupted, to be included in the mechanics deployed.

The orthodontic plan was to bring the root coronally and in a palatal direction to enable the adjacent soft tissue to cover the exposed root.[3,7,10] Occlusal adjustment to create space with the opposing arch was implemented periodically and as needed, so that the tooth would not be under any undesirable occlusal load.

As the tooth was erupted, a narrower part of the root was brought coronally and diastemas appeared **(Fig 6)**. Therefore, a direct composite facing was created over the existing provisional to reproduce again the full contour of the upper central incisor. New bracket was placed, again more gingivally, as orthodontic treatment had not been completed **(Fig 7)**.

Following five weeks of the new orthodontic treatment, a periapical radiograph was taken to verify the progress and evaluate how much root still remained **(Fig 8)**.

It was determined that orthodontic treatment was complete as the desired gingival architecture had been regenerated. At this point, the orthodontic mechanics were stabilized for three months to allow the tissue surrounding the erupted tooth to fully mature and mineralize prior to any surgical procedures **(Fig 9)**.

After three months of splinting, the braces were removed, the remaining root fragment of the central incisor was extracted, and the lateral incisor previously endodontically treated was prepared for a new provisional supporting a cantilever central incisor. The gingival contour of the central incisor was purposely under-contoured to allow for a larger volume of soft tissue to mature around it. Having a normal gingival contour would tend to direct the healing soft tissue in a gingival direction and the intent was to create as much volume of soft tissue as possible **(Fig 10)**.

To prevent any undesirable rotation of the provisional, it was cemented temporarily on the lateral incisor and a lingual wire was bonded to the adjacent central incisor **(Fig 11)**.

Three months after extraction and temporization, a flap revealed adequate bone volume was created post-orthodontic eruption **(Fig 12)**. However, given the demanding esthetic environment and the expectations of the patient, it was decided to over-engineer the case and further enhance labially utilizing a corti-cancellous autogenous graft in a staged approach **(Fig 13)**.

After proper healing of the bone graft and allowing the soft tissue to mature **(Fig 14)**, implant planning was done with the advantage of computerized tomography. Not only was the intent to plan for the best implant position in relation to an esthetic outcome, but also to measure the bone density after all implemented treatment modalities.

Figure 6: As the tooth is erupted, a narrower part of the root is brought coronally and diastemas appear.

Figure 7: Modification of existing provisional to maintain original mesio-distal tooth width and form. Gingival tissues are rapidly adapting to the new tooth position.

Figure 8: Radiograph after five weeks of orthodontic treatment.

Figure 9: New orthodontic treatment completed in five weeks to meet the original objective of improving soft tissues and balancing gingival levels.

Figure 10: The #8 pontic using a subgingivally under-contoured provisional restoration splinted and cantilevered to the lateral incisor and bonded to the adjacent central incisor.

Figure 11: Lingual wire bonded to the adjacent central incisor to prevent rotation on the provisional.

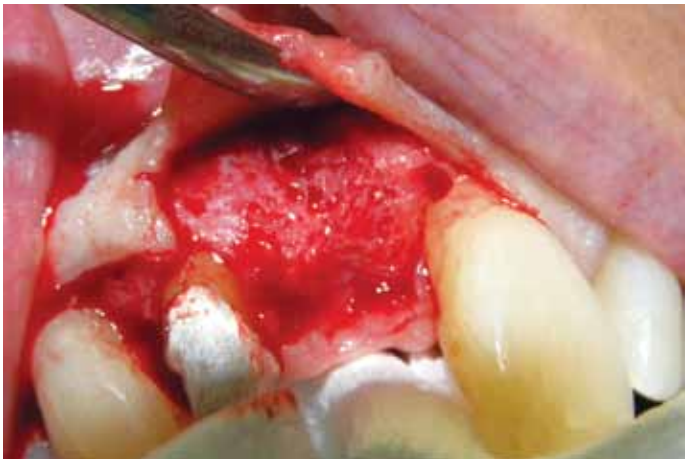

Figure 12: Bone profile post-orthodontic enhancement.

igure 13: Bone graft in place, screw-retained for increased stability.

Figure 14: Provisional in place after the healing of the bone graft.

Figure 15: Colloidal silver painted over existing provisional to highlight tooth contours on the CT image.

After four months of healing, colloidal silver was painted on the provisional to have as a radiopaque reference of the outer contours of the provisional in relation to the available buccal-palatal bone. A computerized tomogram (CT) was taken to generate a digitally-planned surgery **(Fig 15)**.

With the CT information, the implant type, size, width, and length were selected and placed in the best position to enable the projected final restoration to have a properly placed implant **(Fig 16)**. A final impression was taken to create an accurate model to use for a computer-generated surgical guide.

Four months later the provisional was removed and the implant placed with the use of the computer-generated guide, which resembled the computerized planned position. The tissue was allowed to heal for six months[1,2,8,9,15] **(Fig 17)**.

Once it was determined the implant was osseo-integrated, it was conservatively uncovered and a stock abutment was utilized to support a provisional **(Figs 18a & 18b)**. It is important to let the soft tissue heal for several weeks and mature around the abutment. Once the proper soft tissue profile has been created around the implant-abutment-provisional restoration, a final impression can be taken in order to finalize the restoration in the laboratory.

Conclusion

Clearly, when a tooth has been lost or recently extracted and is associated with significant deficiencies, surgical reconstruction or restorative illusions are the only options remaining to clinicians. However, when a hopeless tooth still retains a critical degree of intact apical attachment apparatus, then "orthodontic

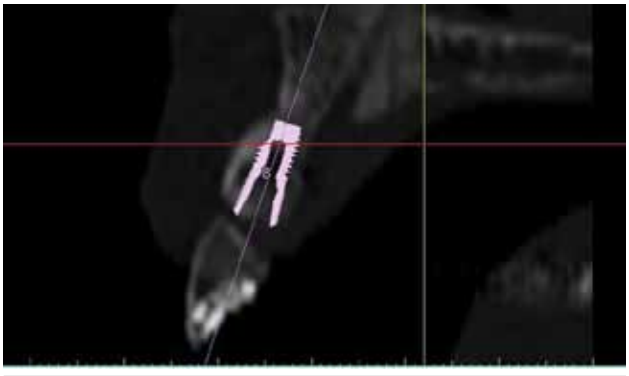

Figure 16: Computerized planning for best possible implant placement.

A MAJOR CONCERN WAS THE EXPECTED POSITION OF THE INTERPROXIMAL PAPILLAE AROUND THE CENTRAL INCISOR WITH THE ANTICIPATED TREATMENT MODALITIES.

Figure 17: Periapical radiograph showing implant in position.

Figure 18a: Implant conservatively uncovered and stock abutment placed to support a provisional restoration.

Figure 18b: Lateral and central incisors with provisional restorations.

extrusion" may be a viable modality to recreate lost hard and soft tissue profiles. This is especially true for patients that may require a cautious surgical approach. Therefore, we must revise our treatment design and make the necessary adjustments during therapy based on the implemented techniques, anticipated results, and host response. Mid-course evaluation can be critical and extremely helpful, even if a change of treatment modalities or sequencing is required. In the case discussed here, multiple treatment modalities—orthodontic, surgical, digital, and restorative—were utilized to regain balance, harmony, and continuity of form in a challenging esthetic environment.

Knowledge and experience can lead us to a proper decision-making process. Part 1 of this article described the diagnosis and tissue reconstructive phase of a severely deficient and hopeless central incisor. Through orthodontic enhancement of bone and soft tissue followed by surgical bone augmentation, an optimal foundation was established for an ideally positioned implant placement. In Part 2 of this article, the authors will describe the restorative and finalizing steps required to successfully follow through on the tissue reconstructive phase and achieve the desired esthetic result.

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Disclosure: The authors have relationships with numerous manufacturers and have financial interest in most new developments in the science and art of dentistry over the past two decades. They did not report any disclosures specific to the content of this article.

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1. The most likely reason for the Class II+ mobility and recession of the maxillary right central incisor is:

a. history of bisphosphonate therapy.
b. excessive tooth brushing.
c. active occlusal trauma.
d. failed root canal.

2. Of the following, the most clinically difficult diagnostic influence(s) would be:

a. high lip line and high patient expectations.
b. low lip line and gingival recession.
c. uneven gingival margins.
d. lack of lingual plate of bone.

3. A major concern in this case is the interproximal papillae around the central incisor. In order to correct this extensive defect:

a. multiple surgical procedures to augment bone and soft tissue should be completed at the same time.
b. multiple procedures involving bone and soft tissue augmentation will be needed with a staged approach.
c. [the defect cannot be managed well due to the history of bisphosphonate therapy].
d. the hopeless tooth should be extracted as soon as possible to preserve bone and soft tissue.

4. Regarding correction of hard and soft tissue defects, orthodontic eruption:

a. should be considered after the hard and soft tissue defects have been corrected.
b. will eliminate the need for surgical correction of hard and soft tissue defects.
c. will enhance coronal soft tissue and increase keratinized gingivae.
d. will minimize bone deposition at the crest as the tooth migrates coronally.

5. During orthodontic eruption, the tooth was:

a. erupted coronally and in a palatal direction to allow the adjacent soft tissue to cover the exposed root.
b. erupted in a buccal direction to enable bone and soft tissue to follow the tooth from the palatal side.
c. first submerged to create additional bone and soft tissue at the base of the tooth prior to eruption.
d. monitored to maintain light occlusion to stimulate bone formation.

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