

OF THE CALIFORNIA DENTAL ASSOCIATION

Journal

AUGUST 2008

Multidisciplinary Care

Provisional Restorations

The Team Approach





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609 THE TEAM APPROACH: SIMPLIFYING COMPLEX CARE

The interaction between the oral and maxillofacial surgeon, the restorative dentist, and the rest of the dental and medical community is the foundation of daily patient care and management. The combination of the talents from each medical and dental discipline results in the highest quality of patient care. This article illustrates the power of the comprehensive team approach.

David Hochwald, DDS; Simona Arcan, DMD, MD; and Fariborz Farnad, DDS

Cost of Putting Patients First: \$0; Professional Credibility: Priceless

STEVEN A. GOLD, DDS

Last week I was asked by two different patients if I heard on the morning news that "... the FDA says that the mercury in silver fillings is bad for you." Being skeptical (without discrediting my patients), I said I would "do a little research on it."

Not by coincidence, I received an e-gram from the ADA exactly two days later explaining the nature of the settlement between the FDA and an anti-amalgam group. Further details were provided on the ADA's Web site. (For those unfamiliar with these developments, the information is currently located under the "Announcements" section of the home page.) Not only was I impressed by the timeliness of the ADA's e-gram, but also by the breadth of informative statements available to the public on their Web site. These included statements about lead in dental prostheses and the safety of fluoride, two topics that continue to see exposure in the media.

What a valuable service this is that the ADA provides to its members; serving as a source of information to the public. Being a trusted source of information is one of the most important roles our local, state and, in this case, our national organization can fulfill. We as individual dentists could never amass the information the ADA can, nor could we make it available in a format so easy for the public to access and understand. Furthermore, legislators and other public policy makers are bombarded by information from both individuals and organizations. They make decisions (hopefully more than occasionally) based on information they receive from trusted sources. Trustworthy organizations such as the ADA and CDA



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are thus vital to the protection of both the public and the profession from poor public policy decisions.

The trust that is placed in a professional organization, such as our dental tripartite, is both precious and delicate and it can be undermined by the very actions of that profession. Most damaging are those messages that reach the public, which sound like either individual dentists or the profession as a whole putting their well-being above that of the patient. The public rightfully holds us to this standard. They rightfully expect us to put them first. This should not be difficult to do. If we hearken back to the more idealistic days of our childhood, or young adulthood, or whatever point in our lives it was that we decided to be dentists, the notion of helping people was no doubt a big part of that decision for all of us.

Putting patients first does not cost anything, yet when we fail to do it, we lose some of the credibility we, as a profession have with them; a credibility which, as we see, is truly priceless. Therefore, we should critically evaluate those actions that can be perceived as being self-serving and ask ourselves how we can do better.

There is a myth that is often thrust upon us by some of the well-known dental "institutes," consultants, members of the dental industry, and even our own

member dentists. This myth says that the quickest way to become financially successful in this profession is to help create a demand for elective, specifically cosmetic, services. Every time these messages reach the public, we lose some of that priceless credibility. Dentists are then implored to fill this demand, oftentimes by taking advantage of their patients' trust and delivering gross overtreatment, including removing healthy tooth enamel to place porcelain veneers and other restorations when no other need for them exists.

Furthermore, this is often done on multiple teeth with inappropriate and adverse changes to a patient's occlusion without the patient being fully informed of the nature of such drastic treatment and its risks. Every time an improperly informed patient has an adverse treatment outcome after having his or her enamel stripped away and replaced with glass, we as a profession lose some of that priceless credibility.

Overly emphasized cosmetic treatment, and its demand, are often fueled by advertising that ignores long-standing principles reflective of a profession that places the care of patients first. Many of us have seen commercials and print advertising more appropriate for selling big-screen TVs than for offering health care. Every day that the public is increasingly besieged by such advertisements hawking

cosmetic dental care, we lose some of that priceless credibility. Dentists are also the targets of potentially credibility-damaging advertising.

There is a limitless stream of publications containing articles and solicitations for services and “continuing education” courses aimed at making dentists as profitable as possible. The emphasis is so geared toward profitability that the message that genuine patient care is involved, if it is present at all, is lost. We would be foolish to think that these messages never reach the eyes and ears of the public, and when they do, we again lose some of that priceless credibility.

Messages that dentistry cares more about profit than patients can even be more subtle, but no less subversive to our credibility. Extreme caution must be used when dental organizations partner with

the for-profit industry side of the profession; for such partnerships can become the source of these public perceptions. Pure altruism by a for-profit entity should not come with strings attached. Our organizations should not indulge them with commercial-like exposure in our scientific journals, on billboards, or other high visibility media. This can cause both questioning of the profession’s motives and dulling of the edge of science. Each time there is such fallout from unwise partnering with industry, we lose some of that priceless credibility.

These actions do not reflect a culture of putting patients first. Whether intended or not, they carry the grave potential of simply damaging our credibility with the public. The day an individual seeking dental information disregards the ADA as a credible source they will turn to

much less scientifically oriented sources. Furthermore, we will find ourselves at the mercy of politicians and government regulatory agencies who base oral health-related public policy decisions not on information provided by our profession, but on information provided by consumer watchdog groups, litigious attorneys, or other individuals and groups with far less scrupulous motives.

When we as a profession have lost our credibility, only then will we realize that we failed to make good on the immense responsibility of ensuring that the public image of dentistry is one of a noble, scientific-based profession comprised of caring individuals who always place the well-being of patients first. ■■■■

Address comments, letters, and questions to the editor at alan.felsenfeld@cda.org.

Are Extended Show, Venue Change Solutions to Crowded Spring Session?

I never write letters to the editor. The Spring Scientific Session at Anaheim is becoming unbearable. The crowds!

Let me start by saying that I cannot even imagine the complexities of putting together a convention of this size. The financial commitment must be enormous too. The big problem is the crowds at this session were way too much for anybody to get anything productive done. It took me 45 minutes to drive the last three-quarters of a mile in front of the convention center. I finally said "It's not worth it," did a U-turn, and left. This was one hour before the convention hall even opened. I live in the next town over from Anaheim and am very familiar with the area and know how to get around, but it was just a mess.

As a dues-paying CDA member for the last 20 years, I think that this is a huge disservice to California dentists. Something must be done so that the dentists who support this organization can take advantage of this meeting. Perhaps the convention needs to run longer. Perhaps the convention needs to be offered twice in Southern California. Perhaps a change of venue. Perhaps scheduling one day when only dentists or hygienists can get in. I love getting team members involved, but the dentists are the ones who are making the decisions in the practice; they are the ones who must be given access.

I never made it inside the hall, but I can imagine the scene inside. Look, we all want to see old friends and I understand these things are about making contacts etc., but I think most dentists simply

want to see what's new, get some questions answered about a couple of products, and maybe take a class or two.

I'm not some old fuddy-duddy. I'm 45 years old. We all want to have some fun, but this convention only rolls around once a year and we need this chance to be able to have all these products and services under one roof, and be able to talk to the representatives.

I enjoy the dental convention. It's a great time to get an update of what's happening out there. Let's start a dialogue about the best ways to handle crowd control so this valuable meeting best serves its members.

ERIC MEYER, DDS
Fullerton, Calif.

You Can Lead a Horse to Water, but You Can't Make Him Brush

I wanted to thank you for Dr. Gold's editorial on parental responsibility for dental health in the May issue of the *Journal of the California Dental Association* (36:321-2).

As you say, we could question what parents value in their family lives — the \$60K SUV, keeping up with the Joneses, etc., but the bottom line is that they will need to answer to the health of their children. Many times children are treated like a possession ... my SUV needs maintenance, I take it to the mechanic. My child has cavities; I send them to the dentist to deal with it.

In my practice, I reinforce the concept that parents have a daily responsibility and accountability to their children to keep their teeth clean. I explain to them

that I only see their children twice a year; who will keep their teeth clean the other 363 days? When parents complain their children don't like having their teeth brushed, we talk about the usual techniques mirroring the parent, having the parent brush after the child brushes, etc., but that's all part of being a parent; brushing isn't the only thing a child doesn't like to do. How do you respond when your child acts that way? Merit reward? Flat out bribery? Whatever works?

I am not an uncaring soul; I have four children's worth of experience. But at some point in our lives as parents, we must communicate a sense of responsibility by the parent AND by the child.

I recently sat in on a focus marketing group where there was a discussion about electric toothbrushes for kids. Most dentists' opinions about children and toothbrushing seemed to be that WE as a profession need to find the magic wand that will solve all our children's brushing problems; even the pedodontists in the group seemed intent on finding that instrument vs. creating accountability of the parent for the child's dental health. A suggestion that the manufacturer create an interactive brushing program that involves the parent and the child got a lukewarm reception. If the parent cannot motivate the child at home, who can?

We as dentists can only do so much for our patients. I don't think we need to feel bad if parents don't recognize their accountability. Like the saying goes, you can only lead a horse to water ...

JOBIE LOW, DDS
San Francisco

Dan Hubig



Journal Seeks New Editor

The California Dental Association is looking for its next editor. The editor, who must be a CDA member, has editorial control over the *Journal of the California Dental*

Association and serves as editorial adviser of the *Update*, subject to policies of the association. The editor also serves as an ex officio member of the Executive Committee, House of Delegates, the Board of Trustees and all other CDA councils and committees, except the Nominating and Volunteer Placement, without the right to vote.

Applications for editor are due no later than Aug. 15, with an anticipated start date in November. More details regarding the duties, requirements, compensation and application information are available online at cda.org/about_cda/leadership/path_to_leadership.



Overfed but Undernourished

BY PATTY REYES

The United States has long been considered the land of milk and honey. But judging by the expanding real estate of a typical citizen's midriff of late, it's also the home of milk chocolate candy the size of large bricks and honey-drenched cereals that only bees can appreciate.

Yes, that's right, America is living large, but not in a good way.

In her presentation "Fattening of America — Where Does Dentistry Fit Into the Puzzle?" during the 2008 California Dental Association Spring Scientific Session, Lisa F. Harper Mallone, BSDH, MPH, RD/LD, associate professor, Department of Dental Hygiene at Baylor College of Dentistry in Dallas, told the crowd about a 5-year-old boy who weighed 117 pounds and had a blood pressure reading of 148/86. (According to a chart by the NIH's National Heart Lung and Blood Institute, a typical blood pressure reading for a 5-year-old, depending on height, is 95/53.) But with an estimated 160 million U.S. citizens dining out daily, mostly at fast-food establishments, Mallone said, is it a surprise?

So, what's eating America? Smoking

CONTINUES ON 545

Tooth Wear Patterns Challenge Long-held Diet of Ancient Hominin

Researchers have cracked the case of the “Nutcracker Man.”

Combining fractal analysis and microscopy to study teeth marks on the ancient human “cousin,” better known as “Nutcracker Man,” researchers discovered the shape and size of its teeth bore no correspondence to what it ate. This discovery by a professor at the University of Arkansas, along with his colleagues, suggest that structure by itself is not enough evidence to predict preferences in diet, and that evolutionary adaptation for eating may have been based on scarcity of food rather than on an animal’s regular diet.

“These findings totally run counter to what people have been saying for the last half a century,” said Peter Ungar, PhD,

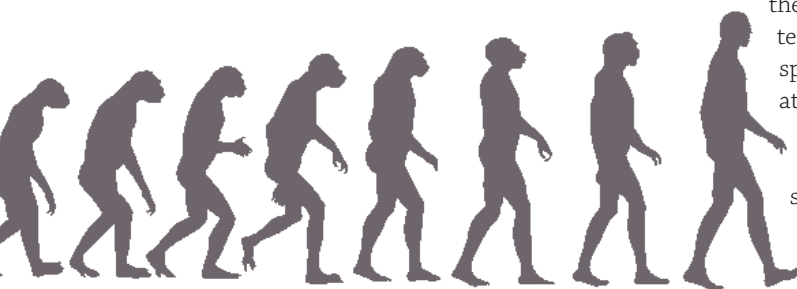
professor of anthropology in the J. William Fulbright College of Arts and Sciences.

“We have to sit back and re-evaluate what we once thought.”

Ungar and colleagues Frederick E. Grine, PhD, of Cambridge University and Stony Brook University and Mark F. Teaford, PhD, of Johns Hopkins University School of Medicine reported their findings in *PLoS One*.

Researchers examined the teeth of *Paranthropus boisei*, an ancient hominin that lived between 2.3 million and 1.2 million years ago that has the thickest enamel of any known hominin as well as the largest, flattest cheek teeth. Since 1959, scientists have believed that *P. boisei* ate seeds, nuts, tubers, and roots on the savannas throughout eastern Africa because the cranium, mandible, and teeth appeared to be built for crunching and chewing hard objects.

“The morphology suggests what *P. boisei* could eat, but not necessarily what it did eat,” Ungar said.



The literature indicated that osteoporosis and related fractures are more common than coronary disease, stroke, and breast cancer.

Oral Health Maintenance Is Key for Osteoporosis Patients

There should be collaboration between dentists and physicians to improve early detection and treatment of patients who have or may develop osteoporosis, according to researchers in a recent issue of *The Journal of the American Dental Association*.

The authors of the article, “Osteoporosis and Its Implications for Dental Patients,” reviewed the medical and dental literature to examine osteoporosis’ effect on public health in the United States. The authors were Beatrice J. Edwards, MD, associate professor of medicine, Feinberg School of Medicine, Northwestern University, Chicago, and coauthor Cesar A. Migliorati, DDS, MS, PhD, professor, oral medicine, Nova Southeastern University, College of Dental Medicine, Fort Lauderdale, Fla.

They also assessed the implications of providing dental care to people who have, or are at risk of, developing osteoporosis.

According to the authors, the literature indicated that osteoporosis and related fractures are more common than coronary disease, stroke, and breast cancer.

Their literature search also revealed that medical management of osteoporosis includes diet control, weight-bearing exercise, discontinuation of tobacco and alcohol intake, and use of medications — including selective estrogen receptor modulators, calcitonin, anabolic agents, and bisphosphonates — that have been associated with the development of osteonecrosis of the jaw.



Bacteremia Risk and Oral Care Evaluated in Study

Blood-borne infections are potentially devastating to the health and well-being of those with a prosthetic joint or a life-threatening heart condition. For that reason, many have been advised to use antibiotic mouth-rinses before visiting a dentist or even brushing their teeth, as a way to kill bacteria and prevent oral pathogens from passing into the bloodstream.

In an article published recently online in the *Journal of Clinical Microbiology*, a team of NIDCR-supported researchers collected blood samples from 290 healthy adults following either two minutes of tooth brushing, a tooth extraction with the recommended accompanying dose of oral amoxicillin, or a tooth extraction with a placebo pill.

According to the study, 151 people developed bacteremia. Utilizing molecular techniques, the scientists identified 98 different bacterial species in the blood. Included among the bacteria were 19 novel species of *Prevotella*, *Fusobacterium*, *Streptococcus*, *Actinomyces*, *Capnocytophaga*, *Selenomonas*, and *Veillonella*.

"Antibiotic prophylaxis reduced the incidence of bacteremia from tooth extraction," the researchers said. "It also resulted in bacteremia with fewer bacterial species, which were cleared from the blood in a shorter time (i.e., mostly within 20 minutes). Although antibiotic prophylaxis reduced the bacteremia of several species of streptococci, as expected, it does not seem to affect species of proteobacteria (e.g., *E. corrodens*) and *Prevotella*."



NYU Dental Researcher Validates 'Old Wives' Tale

Perhaps the source of crabbiness of the "Old Woman Who Lived in a Shoe" was due to her inability to enjoy peanut brittle or taffy.

Stefanie Russell, DDS, MPH, PhD, an assistant professor of Epidemiology and Health Promotion at New York University, recently was able to substantiate the old wives' tale that for every child birthed, the mother lost a tooth. With so many kids, "she didn't know what to do," it could be conjectured the shoe-dwelling, overwhelmed mom was more than likely fairly edentulous.

Women who have more children are more likely to have missing teeth, according to a nationwide study of 2,635 women, said Russell, who was able to base her conclusions on white and black non-Hispanic women between the ages of 18 to 64 who reported at least one pregnancy in the Third National Health and Nutrition Examination Survey, a representative study of the U.S. population.

Her findings were published on the Web

site of the *American Journal of Public Health*.

"This is the first time we've seen a connection between pregnancy and tooth loss affecting women at all socioeconomic levels in a large, heterogeneous sample of the U.S. population," Russell commented.

Profound biological and behavioral changes related to pregnancy and child birth are likely to be a factor in tooth loss, Russell found. For example:

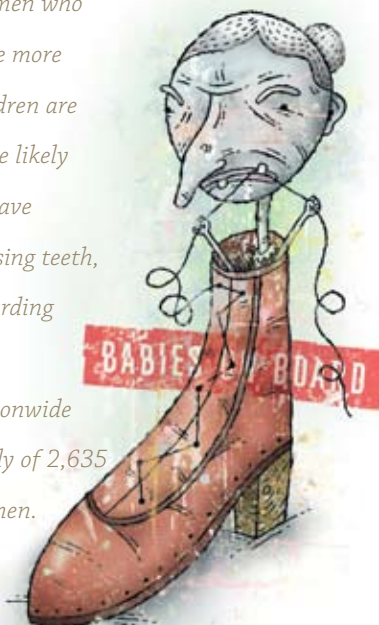
- Pregnancy can make women prone to gingivitis. Repeated pregnancies are likely to result in more frequent outbreaks of gingivitis that may lead to tooth loss in women with periodontitis.

- A woman may postpone seeking dental treatment because of financial concerns related to having children.

- Caring for more children may lead a mother to cut back on the time she devotes to her own oral health.

"Although further research is needed on the specific reasons for the link between pregnancy and tooth loss, it is clear that women with multiple children need to be especially vigilant about their oral health," said Russell.

Women who have more children are more likely to have missing teeth, according to a nationwide study of 2,635 women.



Matt Mullin



"Given a choice for grafts, nothing is better than a patient's own tissue."

HESSAM NOWZARI

DDS, PHD

New Procedure Can Speed Up Process to Straighter Teeth

Teeth straightening and a killer smile in months instead of years? It can be done, say researchers at the University of Southern California School of Dentistry.

Hessam Nowzari DDS, PhD, director of the USC School of Dentistry and Advanced Education in Periodontology program, led a team of researchers who have published the first case study of the successful use of a patient's own bone material for the grafting necessary in a surgical procedure developed by a Pennsylvania periodontist, Tom Wilcko, DMD. The report appeared in the May 2008 issue of the *Compendium of Continuing Education in Dentistry*.

"Given a choice for grafts, nothing is better than a patient's own tissue," Nowzari said. "It encourages new, healthy bone

formation in the grafted area. It's very safe and eliminates the risk of any disease transmission."

Wilcko offers courses in the procedure, trademarked as "Wilckodontics." The dentists from USC used the procedure Periodontally Accelerated Osteogenic Orthodontics, PAOO. With this technique, an oral surgeon or periodontist uses special instruments to score the bone holding the teeth in place and then applies bone graft material over the grooves. A local anesthetic is used in a dental office operatory.

The bone softens slightly as it starts to heal, allowing teeth to be moved into alignment with braces in a matter of months, instead of the years typically required by traditional orthodontics, according to a press release.

UPCOMING MEETINGS

2008

Sept. 6-9	94th annual meeting, American Academy of Periodontology, Seattle, Wash., perio.org/meetings .
Sept. 12-14	CDA Fall Scientific Session, San Francisco, 800-CDA-SMILE (232-7645), cda.org .
Sept. 24-27	FDI Annual World Dental Congress, Stockholm, congress@fdiworldental.org .
Oct. 16-19	American Dental Association 149th Annual Session, San Antonio, Texas, ada.org .
Oct. 25-29	American Public Health Association Oral Health Section's annual meeting and exposition, San Diego, www.apha.org/meetings .
Nov. 2-8	United States Dental Tennis Association Fall meeting, Palm Desert, dentaltennis.org .

2009

May 14-17	CDA Spring Scientific Session, Anaheim, 800-CDA-SMILE (232-7645), cda.org .
Sept. 11-13	CDA Fall Scientific Session, San Francisco, 800-CDA-SMILE (232-7645), cda.org .
Oct. 1-4	American Dental Association 150th Annual Session, Honolulu, Hawaii, ada.org .
Nov. 8-14	United States Dental Tennis Association Fall meeting, Scottsdale, Ariz., dentaltennis.org .

To have an event included on this list of nonprofit association continuing education meetings, please send the information to Upcoming Meetings, CDA Journal, 1201 K St., 16th Floor, Sacramento, CA 95814 or fax the information to 916-554-5962.

Honors

Arthur A. Dugoni, DDS, MSD, Palo Alto, Calif., dean emeritus of the Arthur A. Dugoni School of Dentistry, was named an honorary lifetime member of the Marin County Dental Society.

Dr. Basma Fallah, DDS, MS, San Mateo, Calif., a 2007 graduate of the Arthur A. Dugoni School of Dentistry orthodontic program, was awarded the American Association of Orthodontists 2008 Harry Sicher Research Award.



**Arthur A. Dugoni,
DDS, MSD**



**Dr. Basma Fallah,
DDS, MS**

Zap Lasers Unveil Styla MicroLaser

A breakthrough in soft-tissue management, the Styla MicroLaser is the world's first microlaser for soft-tissue applications. The 1.9 ounce-Styla combines revolutionary design and proven diode laser technology in a self-contained unit measuring only 6.9 inches long. The

hand-held Styla has no wires or cables, allowing dental professionals to move freely throughout treatment areas. The Styla MicroLaser is available for preorder directly from Zap via the company Web site, www.zaplasers.com/styla or call (888) 876-4546.

OVERFED, CONTINUED FROM 541

cessation, medications, and not getting enough shut eye, are among the contributors to obesity. "You need a good six to eight good hours," Mallone said of sleep. "If you don't get enough, you're so tired, you turn to food for energy." Other factors Mallone mentioned may be attributed to:

- Genetics
- Illness, resulting in limited physical activity
- Food companies marketing to young children
- Fast food and its around-the-clock availability as well as its expanded portions and inexpensive cost

Mallone, who referred to a knife and fork as potential weapons of mass destruction, said 1 in 5 children are overweight. "Today's kids are projected to live shorter lifespans than their parents; and 1 in 3 kids are at risk for type 2 diabetes."

Rare is the case that someone can eat a plateful of 101 fried things and nosh on a slice of pepperoni pizza as "dessert" without deleterious effects to one's health.

"We are overfed but undernourished, the foods we eat are calorie-dense, not nutrition-dense," she said. "We're eating more but doing less."

Mallone held up her own family as an

example. She recounted an occasion when she and her husband wasted

time looking for the remote control rather than getting off the sofa to switch on the TV and change the channels.

How does obesity affect the dental profession? For starters, the poor food choices and habits may increase a patient's caries risk as well as pose challenges to a treating dentist. "Obese patients may need to be placed upright due to possible difficulty breathing when in a supine position for an extended period of time," Mallone said.

Other ways, according to Mallone's handout, dentists can be an integral part of their patient's oral and overall health:

- Conduct a comprehensive review of the patient's medical history to determine if the patient has other systemic diseases that coexist with increased weight that may prevent factors for treatment.
- Document any weight management medications, supplements or herbal products in the dental chart.
- Look for signs of iron or vitamin deficiency.
- In the oral exam, be alert to changes



that might indicate deficiency such as glossitis, stomatitis, ulceration, and angular cheilitis. If present,

offer palliative oral health care tips.

- Refer the patient to a registered dietician and physician, if necessary, for additional evaluation and treatment of the etiology.

- Dental professionals can work with a registered dietician to offer support through nutrition counseling and weight management, as well as reinforce the benefits to a patient's oral health from having a more healthful diet.

- Assess diet to determine intake of carbohydrates as part of caries risk management.

- Give information about caries formation and its relationship to diet; provide education on caries control.

- Oral hygiene and daily fluoride may be indicated, depending on the patient's caries status.

- Emphasize the need for regular physical activity. And before doing so, remind them to visit their physician prior to starting an exercise program.

"Don't discount the influence dentists can have on patients," Mallone said.



Dental Museum Wins Kudos for Education Efforts

In recognition of its dedication in promoting public oral health awareness through new and creative educational programs for children, the Dr. Samuel D. Harris National Museum of Dentistry has been honored with the 2008 Shils Award.

The museum earned kudos for its dedication to connecting the ideas of a healthy life and good oral health through its local and national programs, as well as its Web site, as a way to encourage people to take an active interest in their oral health care.

"The National Museum of Dentistry makes a national impact educating the public about the importance of good oral health to a healthy life," said NMD Executive Director Rosemary Fetter. "We are extremely honored to be recognized for innovative programming that is affecting the oral health of children across the country."

George Washington's lower denture calls the museum home. Other interesting

educational tools range from exhibits to a learning laboratory resembling a kid-sized dental chair, lab coats, and faux X-rays to hands-on models that let children explore how to properly floss and brush while also teaching them to eat healthy, exploring the many careers in dentistry, and avoiding tobacco.

The MouthPower online program shares the power of a healthy smile with children across the country through an entertaining and educational Web experience developed in partnership with the American Dental Association. It is accessible in English and Spanish and has been visited by more than 250,000 visitors.

In 2002, the Dr. Edward B. Shils Entrepreneurial Education Fund was founded to recognize outstanding entrepreneurial initiatives that educate the community at large on the impact of oral health or provide educational opportunities for those in the dental industry and profession. It operates under the administration of the American Dental Association Foundation.

Dental Implant Coating Shows Promise

Pure titanium, the material of choice for many medical and dental implants, has a surface that is biologically inert, making it biocompatible so as to not trigger an unwanted reaction from the immune system. The metal, however, does not initiate new growth of blood vessels and bone around an implant, and is not generally incorporated into the implant site.

Over the years, researchers have tried to solve this puzzler with approaches such as developing various coating materials that would not trigger an immune response and lead to better incorporation by living tissue at the site of the implant. In an upcoming issue of the *International Journal of Nanomanufacturing*, it is suggested that coating dental implants with a synthetic bone material before implantation in the jaw may be successful.

Commercially available composite materials, such as "Bonelike" a synthetic bone material, hydroxyapatite reinforced with tiny glass particles, maybe used to provide a layer on the surface of pure titanium, leading to better incorporation.

Researchers from the Biomedical Engineering Institute in Porto, Portugal, investigated how well 27 titanium implants coated with Bonelike were incorporated. The implant rods, 10 mm long and almost 4 mm in diameter were placed in the maxilla (18) and mandible (9) of seven patients, prior to the attachment of an artificial tooth.

Before and after X-rays at three and six months allowed the team to assess how the implants had grown in, showed new bone growth around the implants, and showed there was no bone loss in the surrounding regions of the jaws. "The Bonelike-coated dental implants proved to be highly bioactive with extensive new bone formation and attachment," said researchers.

TREATMENT PLANNING: An Art or a Science?

SAJID JIVRAJ, DDS, MSED

GUEST EDITOR

Sajid Jivraj, DDS, MSED, is an associate clinical professor, former chairman section of fixed prosthodontics and operative dentistry University of Southern California, School of Dentistry, Los Angeles, and in private practice in Oxnard, Calif.

Today, the practice of dentistry requires an interdisciplinary approach that integrates the knowledge, skills, and experience of all the disciplines of dentistry into a comprehensive treatment plan.

Prosthodontics can offer exceptional satisfaction to both the patient and dentist. It can transform an unhealthy, unattractive dentition with poor function into a comfortable, healthy occlusion capable of providing years of further service, whilst at the same time greatly enhancing the esthetic result.¹

To obtain optimal results, meticulous attention must be paid to a myriad of details. The process starts with the patient interview and meticulous treatment planning, continues through to active treatment, and culminates in regular planned follow-up care.

The objectives are to improve oral health, to establish proper occlusal function, and to create the most ideal esthetic result possible. It is only through an organized and systematic approach that appropriate diagnoses can be made, and based on these diagnoses, functional and esthetic problems can be addressed predictably.

Interdisciplinary therapy involves the combination of diagnostic, treatment planning, and therapeutic procedures. It is imperative the team leader appropriately selects a team of practitioners. The selection process can either have a positive or a negative impact on the overall treatment. Each provider on the team must have an optimal level of skill in his or her area of expertise to be a positive factor.² The complex nature of dentofacial problems necessitates a highly organized method of communication between the team members so that all aspects of treatment can be equally voiced.

It is through this communication that an interdisciplinary treatment plan can be

formulated prior to generation of a joint treatment letter. This treatment letter should include a discussion of aspects of treatment that will be provided by each team member, the time frame of the proposed treatment, the inherent risks involved, informed consent, and the financial responsibilities of the patient. It can be said that the quality of treatment is dependent upon the quality of the communication. It is critical the team leader maintains communication between the specialists both during treatment and once it has been completed. It is only through this approach that optimal care can be delivered and regular planned

follow-up care can be implemented.

Treatment planning must begin through visualization of the end result. By paying attention to details, systematically analyzing each factor that affects the esthetic result, recognizing inadequacies in crown contour and gingival margin levels prior to restorative intervention, the restorative dentist can take advantage of the benefits of orthodontic and periodontal treatment to enhance the esthetic and functional outcomes.

The objective of each article is to outline how each specialty can enhance the final outcomes of treatment. Dr. Yorita will discuss the impact of orthodontics on treatment planning and how anchorage can be obtained when teeth are missing. Drs. Handelsman, Ravon, and Levine will address management of the periodontium and how subtle procedures can enhance the esthetic outcome. Dr. Hochwald's paper will describe how surgical procedures can re-establish optimum occlusion and how communicating with the restorative dentist is key in obtaining optimal outcomes. Finally, Dr. Reshad and I will provide a prosthodontic perspective in management of patients requiring restoration of posterior support and how to transition patients from a tooth-supported to an implant-supported occlusion.

My intention with this issue is to stimulate critical thinking and to offer the patient options for optimum care. Without an interdisciplinary approach, final outcomes can be compromised. With a team approach to the management of patients who require prosthodontic treatment, fewer compromises will occur and more ideal restorations can be developed. ■■■■

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The Influence of Posterior Occlusion When Restoring Anterior Teeth

MAMALY RESHAD, DDS, MSC, AND SAJID JIVRAJ, DDS, MSED

ABSTRACT When any type of esthetic restorative procedure is being considered or performed, a comprehensive diagnosis and treatment plan is required. Attention to the diagnostic signs of the loss of posterior support (LPS) and their influence on the anterior dentition will guarantee a more predictable outcome. Historical solutions and their inadequacies are addressed. Patient presentations are utilized to demonstrate contemporary treatment of patients requiring esthetic rehabilitations who are lacking posterior support.

AUTHORS

Mamaly Reshad, DDS, MSC, is an assistant professor of clinical dentistry, and co-chair for fixed prosthodontics and operative dentistry, Division of Primary Oral Healthcare, University of Southern California, School of Dentistry, Los Angeles.

Sajid Jivraj, DDS, MSED, is an associate clinical professor, former chairman section of fixed prosthodontics and operative dentistry University of Southern California, School of Dentistry, Los Angeles, and in private practice in Oxnard, Calif.

There is a general consensus that tooth retention amongst the aging population pays credence to preventive dentistry and patient education.¹ Appearance is a common concern for this group of patients. A comprehensive examination allows the clinician to diagnose risk factors that are responsible for the deterioration of oral health and function. These patients often request restorative treatment with indirect restorations to enhance their appearance (**FIGURE 1**). During the diagnostic phase, critical elements of posterior occlusion are overlooked at the expense of longevity of the proposed treatment (**FIGURES 2 AND 3**). Health, function, and esthetics should be the ultimate aim of any medical or dental comprehensive treatment plan.²

Diagnosis

Diagnosis and treatment planning cannot be based on esthetic desires alone. A number of factors need to be evaluated prior to decision making:

- Occlusal stability
- Status of periodontal and dental disease
- Anatomical limitations
- Space management

Posterior support is an important factor to consider in order to achieve occlusal stability. The loss of posterior support is defined as the loss of occluding vertical dimension as a result of the loss or drifting of posterior teeth.³ Secondary occlusal trauma has been defined as the effects induced by occlusal force (normal or abnormal) acting on teeth with decreased periodontal sup-



FIGURE 1. Maxillary anterior teeth restored with porcelain laminate veneers for patient with adequate posterior support and occlusal stability.



FIGURE 2A. Maxillary anterior teeth previously restored but failed due to posterior bite collapse.



FIGURE 2B. Posterior support needs to be established before anterior teeth are restored.

port.³ Hence, it is possible for a patient with an almost intact dentition, but with a reduced periodontium to present with the signs of LPS (**FIGURE 4**).

Clinically, such a diagnosis is based upon five cardinal signs (**FIGURES 2 AND 3**):

- PDL widening
- Fremitus
- Fractured restorations
- Drifting
- Excessive wear

Treatment Solutions for the Loss of Posterior Support

Solutions for the treatment of patients presenting with the clinical signs of the loss of posterior support include:

- Removable partial dentures (RPD)
- Cross-arch splinting
- Implant-supported restorations

Removable Partial Dentures

There remains a group of patients that for medical, psychological, and financial reasons are poor candidates for fixed prosthodontics. These patients can be restored to function with the use of RPDs. Patient selection and the correct diagnosis are critical when deciding if treatment with removable prosthesis is appropriate. When treating a patient who exhibits the cardinal signs of LPS, a tooth or implant (supported and/or retained) RPD can provide additional support. With appropriate diagnosis and case selection these types of RPDs can satisfy the patient's functional needs.

However, there remains a group of



FIGURE 2C. Cardinal signs for LPS are present clinically.

patients who do not have an adequate number of posterior teeth or implants for a tooth-/implant-supported, or retained RPD. For this group of patients, tooth replacement with a mucosal-supported RPD may not have any functional benefits and posterior support will not be re-established, leading to further demise of the dentition.

Restoring posterior support with mucosal-supported RPDs is controversial from a mechanical and periodontal view point. Whilst under load, the mucosa moves millimeters while natural teeth only move a mere 25-50 microns.⁴ This is based on the concept of differential movement of the mucosal tissues (millimeters) and the teeth (25-50 microns). These biomechanical issues compounded with patient compliance (25 percent of denture wearers never use their dentures) make it harder for a mucosal-supported RPD to provide adequate posterior support⁵ (**FIGURE 3**). Prospective controlled studies have also shown that the oral function of subjects with a shortened dental arch (SDA) did not differ compared to subjects who have a SDA and were wearing a RPD.⁶⁻⁸



FIGURE 2D. Cardinal signs for LPS are present radiographically.

Therefore, a distal extension RPD did not appear to provide the patient with any additional posterior support or occlusal stability. Another survey of 77 patients with RPDs, reported social and oral function at levels compared to those with no dentures.⁹ There appears to be little need to replace lost posterior teeth with dentures until the person has fewer than three posterior functional units. The authors could not detect a lasting benefit from RPD wear.

The functional benefits of RPDs remain controversial as definitive controlled clinical trials have yet to be performed. However, based on current data and a logical approach to diagnosis and treatment planning, one should employ more caution when opting to restore a patient who exhibits LPS with a RPD.

Effect of RPD on Periodontal Status

Many studies have looked at the effect of RPDs on dental and periodontal structures.^{10,11} Some have concluded that with a high level of periodontal maintenance and oral hygiene RPDs do not result in periodontal disease.¹⁰ However, there is evidence to the



FIGURE 3A. Patient presented with LPS.



FIGURE 3B. Mucosal-supported RPD failed to provide posterior support.



FIGURE 3C. Cardinal signs of LPS are present.

contrary. In one controlled in-vivo study of 99 patients, it was found that “There was a strong correlation between the presence of local pathological alterations accompanying the use of RPDs and poor oral hygiene.”¹¹

Eighteen to 25 percent of RPD abutments were “loose” and periodontal inflammation was associated with 68 percent of all abutments. In another 10-year study, survival rates of teeth adjacent to treated and untreated posterior bounded edentulous spaces, it was found that survival of teeth adjacent to a single posterior edentulous space was negatively associated with RPD placement compared with no treatment.¹² If the patient with a mucosal-supported RPD is unable to maintain an adequate level of oral hygiene, further tooth loss is more likely. Losing more teeth will worsen the problem associated with LPS.

RPDs functional benefits remain controversial as definitive-controlled

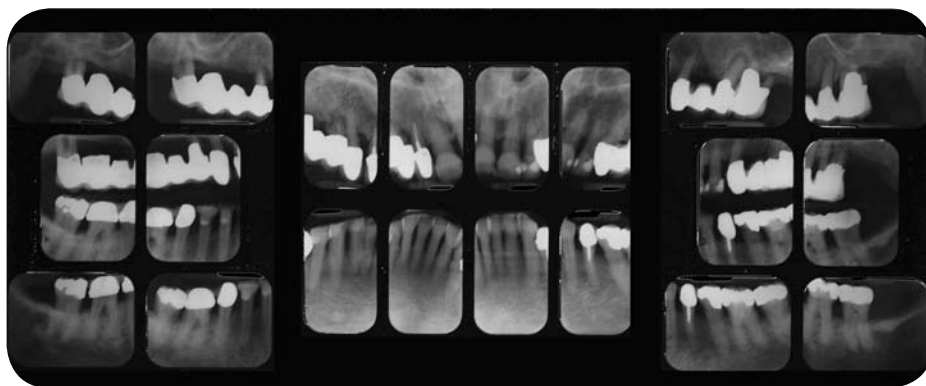


FIGURE 4. Radiographs of patient with almost intact dentition but with reduced periodontium with the signs of LPS.

clinical trials have yet to be performed. The ability to draw consensus on the benefits and impacts based on currently available data may be premature. The majority of evidence is from correlational, poorly controlled studies with biased or select samples. However, current data should not be disregarded as it does provide some useful information in relation to clinical outcomes and trends.

Cross-arch Splinting

Cross-arch splinting has also been used to treat patients diagnosed with LPS. Adequate oral hygiene, and sufficient number of abutment teeth are essential to the success of such treatment modalities¹³ (**FIGURE 5**). The patient in **FIGURE 5** received a periodontal prosthesis more than 20 years ago. This should be considered a successful

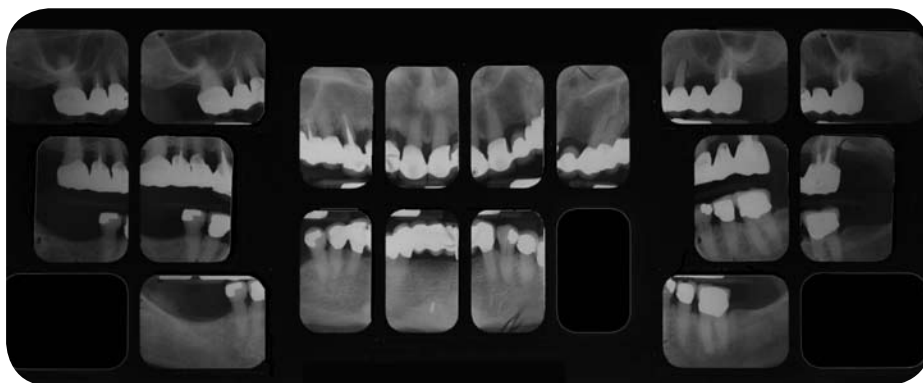


FIGURE 5A. Radiographs of maxillary reconstruction with cross-arch stabilization at 20 years.



FIGURE 5B. Occlusal view of maxillary reconstruction with chipped ceramics, dental caries, and fractured connector necessitating replacement of prosthesis at 20 years (Courtesy of Nikitas Mordohai, DDS).

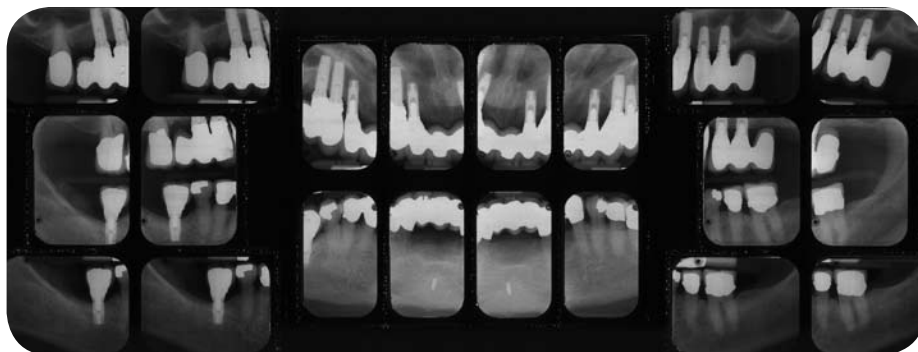


FIGURE 6A. Radiographs of patient in Figure 5 after maxillary reconstruction with dental implant supported restorations (Courtesy of Dr. Mordohai).



FIGURE 6B. Right lateral view of maxillary implant-supported restorations.



FIGURE 6C. Left lateral view of maxillary implant-supported restorations.

restoration. However, had failure occurred a short period after delivery of the definitive restorations, the consequences may have been catastrophic. As every tooth is joined together in a single prosthesis, a localized problem may deem the restoration or a large part of it nonfunctional, requiring replacement. The risk-to-benefit ratio for these restorations is unfavorable.¹⁴ It has been said that “for every advantage splinting has to offer there is at least one disadvantage that must be accepted.”¹⁵

FIGURE 6 demonstrates how the failed prosthesis in **FIGURE 5** was remade with the use of dental implants for support. “New sophisticated techniques are available, but the concept of a correct diagnosis, identifying the etiological factors, formulating a treatment plan and developing a logical sequence of therapy hold true today as they did five decades ago.”¹⁶

Implant-supported Restorations

The use of osseointegrated dental implants have defied many of the empiri-

cal guidelines previously accepted.¹⁷ The survival of cantilevered restorations supported by four to five short dental implants in the symphysis of the mandible is well documented.^{18,19} These complete mandibular prostheses, which replace 12 to 14 teeth, with up to 10-15 mm posterior cantilevers clearly defy the empirical rules that have been religiously followed in clinical dentistry (**FIGURE 7**). A new era in clinical dentistry has arrived. Two patients are selected to demonstrate the contemporary treatment of the loss of posterior support.

The patient in **FIGURES 4 AND 8** presented with the cardinal signs for LPS. In order to establish posterior support the treatment plan for this patient consisted of:

1. The removal of the teeth with poor or nonmaintainable prognosis¹⁴;
2. Bilateral sinus lifts²⁰; and
3. Replacement of missing teeth with implant-supported restorations.

After removal of the maxillary teeth and prior to dental implant placement, an immediately loaded provisional prosthesis was delivered to restore the dentition and establish posterior support. Three transitional dental implants were used as abutments for the immediately loaded prosthesis in order to establish posterior support (**FIGURE 9**). The pa-



FIGURE 7A. Photo of mandibular hybrid prosthesis supported by five short dental implants and cantilevered.



FIGURES 7B. Radiograph of mandibular hybrid prosthesis.



FIGURE 8. Preoperative photo of patient. Cardinal signs of LPS are present with an almost intact dentition. Generalized periodontal attachment loss is the cause of LPS.

tient was stabilized in terms of disease control, occlusion, function, phonetics, and esthetics. The immediately loaded transitional dental implants were removed once the definitive dental implants were osseointegrated and loaded. The additional step of providing the patient with a transitional implant-supported provisional restoration ensured patient comfort during the osseointegration period while minimizing the risk of uncontrolled loading and micromotion of the definitive dental implants.²¹

Once osseointegration of definitive dental implants had been established, indirect provisional restorations were fabricated to maintain posterior support. The provisional restorations (**FIGURE 10**) allowed objective evaluation of occlusal stability, phonetics, and esthetics prior to the fabrication of the definitive restorations²² (**FIGURE 11**). Comparison of the photos in **FIGURES 10 AND 11** demonstrates how the treatment objectives that were established and tested with the provisional restorations were duplicated in the definitive restorations. Posterior support had been established with the aid of implant-supported restorations.

The patient in **FIGURE 12** presented with pathological loss of tooth structure, which resulted in posterior bite collapse and loss of vertical dimension of occlusion.^{3,23-25} Radiographs clearly show the extent of damage to the dentition (**FIGURE 12**). Many teeth had also been affected by pathological tooth surface loss associated with attrition and erosion.²³ Signs of both diurnal



FIGURE 9A. Three transitional dental implants are used to provide posterior support and function.



FIGURE 9C. Occlusal view showing copings on transitional dental implants indexed to maxillary provisional restoration with acrylic resin.



FIGURE 10A. Right lateral view of definitive implant-supported provisional restorations.



FIGURE 11A. Right lateral view of definitive restorations.

and nocturnal bruxism were clearly visible on presentation. The proximity of the chin to nose distance and the presence of angular folds and angular cheilitis confirmed the diagnosis of the loss of vertical dimension of occlusion (**FIGURE 13**).



FIGURE 9B. Intaglio surface of maxillary immediately loaded provisional restoration.



FIGURE 9D. Satisfactory esthetics achieved with the implant-supported and immediately loaded provisional restoration.



FIGURE 10B. Left lateral view of definitive implant-supported provisional restorations.



FIGURES 11B. Left lateral view of definitive restorations.

In order to re-establish posterior support for this patient, it was decided to restore the maxillary teeth with tooth-supported cast restorations, and the mandibular teeth with implant-supported restorations. The provisional



FIGURE 12A. Radiographs of a patient with a severely compromised dentition on presentation.

restorations allowed objective evaluation of occlusal stability, phonetics, and esthetics prior to the fabrication of the definitive restorations.²² The decision to immediately load the mandibular arch for this patient was based on a combination of factors (**FIGURE 14**).

Firstly, success with immediate loading of the mandible is well documented.^{26,27} Secondly, patients wearing complete mandibular dentures opposing a fixed prosthesis in the maxilla tend to have poor acceptance of treatment. Thirdly, the provision of a fixed prosthesis in the mandible for this patient will immediately overcome the two major diagnostic findings for this patient. Posterior support and vertical dimension were both re-established with immediate effect. The osseointegration period may coincide with the testing of form, function, phonetics, and esthetics with the provisional restorations.²² The patient was stabilized in terms of disease control, occlusion, function, phonetics, and esthetics.

After the process of osseointegration definitive restorations were fabricated. Full-mouth radiographs confirmed optimum oral health and anatomic harmony (**FIGURE 15**). **FIGURE 15** demonstrates how occlusal stability and functional harmony were re-established for this patient. Adequate esthetics was achieved in a controlled, objective, and predictable fashion (**FIGURE 16**). A hard occlusal guard was delivered to protect the restorations from excessive forces created during diurnal and nocturnal bruxism.²⁸



FIGURE 13. Patient presented with persistent angular folds and cheilitis relating to loss of vertical dimension of occlusion.



FIGURE 12B. Intraoral photograph of patient in Figure 12a.



FIGURE 14. Provisional restorations. The mandibular arch with immediately loaded prosthesis at two weeks.

Discussion

LPS is a true disease that is most often overlooked. The diagnosis of such disease is defined with cardinal clinical signs and symptoms. Although there is a new tool in our armamentarium (dental implants), the principles of diagnosis and treatment planning remain the same. The treatment for LPS is still controversial and a comprehensive treatment should include detailed occlusal and periodontal diagnosis in order to ensure the longevity of the restorations. Adequate posterior support should be one of the requirements for long-lasting anterior restorations.

Historically, a common misconception has been related to the deleterious effects of the loss of posterior teeth on the remaining dentition and health.²⁹ A common belief was that 80 medical and dental abnormalities would result from the loss of posterior teeth.²⁹ The belief that missing teeth result in arch collapse and the loss of arch integrity is also evident in more recent dental literature.³⁰⁻³² In fact,

it is apparent that missing posterior teeth do not necessarily result in LPS or the loss of occlusal integrity.³³ It is unnecessary to replace all missing posterior teeth to avoid problems associated with LPS.³⁴ The efficacy of a shortened dental arch has been confirmed.³⁵ A shortened dental arch has been defined as a dentition with a reduction of occlusal units (pairs of occluding premolars and molars) starting posteriorly.³⁵ The prevalence of the shortened dental arch has been estimated at 25 percent for 41- to 45-year olds and 70 percent for 61- to 65-year olds.³⁶ The question about the function, occlusal integrity, adaptive capacity, and esthetics in relation to the latter group has been addressed and answered. It appears that functional demands can be met even with some loss of molar support.³⁷

Epidemiological studies show a lack of correlation between the loss of molar support and impaired oral function.³⁸ There is sufficient adaptive capacity to ensure acceptable oral function in the shortened dental arch when premolar



FIGURE 15. Full-mouth radiographs and photograph of definitive restorations.

teeth are present.³⁸ The SDA can provide long-term occlusal stability.⁶⁻⁸ Esthetics does not seem to be adversely affected by missing posterior teeth either. In a survey of patients with a shortened dental arch it was evident that these patients rate their appearance as acceptable.³⁷

The decision to intervene when a patient is missing posterior teeth should be based on a comprehensive diagnosis and treatment plan. The main diagnostic findings of LPS must be established before any intervention and treatment. The combination of existing periodontal involvement and increased occlusal loading, such as in a reduced dentition, appear to be potential risk factors for further loss of teeth.³⁹

Conclusion and Clinical Significance

When any type of esthetic restorative procedure is being considered or performed, a comprehensive diagnosis and treatment plan is required. This should include a close analysis of the total stomatognathic system with particular attention to posterior support. ■■■■

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FIGURE 15B.



FIGURE 16. Patient smiling with definitive restorations.

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CONTACT Mamaly Reshad DDS, MSc, University of Southern California, School of Dentistry, Department of Advanced Graduate Prosthodontics, 925 West 34th St., Los Angeles, Calif., 90089-0641.



Multidisciplinary Care: Periodontal Aspects to Treatment Planning the Anterior Esthetic Zone

NICOLAS A. RAVON, DDS, MSD; MARK HANDELSMAN, DDS; AND DAVID LEVINE, DDS

ABSTRACT The field of periodontology has changed dramatically during the past 30 years. The goal of periodontal therapy is not only to establish and maintain the dentition and the periodontium free of any oral infections, but also to provide an environment with optimal function and esthetics. Esthetics has become an integral portion of the overall treatment goal in periodontics. This article discusses the role of periodontal plastic and reconstructive surgery in treatment planning the anterior esthetic zone in interdisciplinary dental care.

AUTHORS

Nicolas A. Ravon, DDS, MSD, is a diplomate, American Board Periodontology, and in private practice in Burbank, Calif.

Mark Handelsman, DDS, is a diplomate, American Board Periodontology, and in private practice in Santa Monica, Calif.

David Levine, DDS, is a diplomate, American Board Periodontology, an associate clinical professor at the University of Southern California, School of Dentistry, and in private practice in Burbank, Calif.

The signs of periodontal disease are often varied and complex. In order to determine a meaningful treatment plan, a proper diagnosis is essential. This can only be determined through a comprehensive examination and collection of the precise clinical characteristics of the patient's overall periodontal condition. In performing the periodontal examination and developing a treatment plan, care must be taken to consider all aspects of the patient, including their overall functional status.

Consultation with other specialists (restorative dentist, oral surgeon, orthodontist, endodontist) regarding the restorative and endodontic health, and any occlusal, skeletal, and space problems, is required. All the treating specialists on the team need to collabo-

rate their findings. An evaluation and understanding of the etiology of the pathologic process is extremely important. A correct diagnosis with long-term prognostic information is mandatory to develop an interdisciplinary treatment plan. This article will review periodontal aspects of treatment planning with an emphasis on the anterior esthetic zone.

The American Academy of Periodontology has developed parameters on a comprehensive periodontal examination.¹ These parameters are discussed below.

First in any examination should be a review of the patient's medical history. Those systemic conditions or behavioral characteristics that may contribute or predispose to periodontal disease should be noted and discussed with the patient. Such conditions include but are not limited to diabetes, smok-



FIGURE 1A. Thin and scalloped periodontium.



FIGURE 1B. Thick and flat periodontium.



FIGURE 2. Healthy smile with high smile line.

ing, hypertension, and pregnancy.

A review of the dental history is also important. This information should include the patient's main reason for seeking treatment as well as past dental treatment and previous radiographs. Has the patient been compliant and has the patient received adequate follow up care is also important information to know.

Extraoral and intraoral structures should be examined and evaluated. Any temporomandibular joint issues should be discussed. The oral mucosa, lips, floor of the mouth, muscles of mastication, salivary glands, palate, and the oropharynx should all be evaluated.

An evaluation of the teeth should include observation of missing teeth, condition of restorations, caries, tooth mobility, tooth position, occlusal and interdental relationships, signs of parafunctional habits, and if applicable, pulpal status.² Proximal contact relationships are also important to note as some open contacts can impact food, which can contribute to the progression of disease. Any furcation involvement should be evaluated and noted.

A comprehensive periodontal examination includes the hard and soft supporting tissues of the dentition. Clinical findings and radiographic findings need to be evaluated. Radiographs should be evaluated to help determine the status of the periodontium and dental implants. Radiographs should be diagnostic and based on the needs of the patient. Clinically, the patient's tissue biotype is classified according to how thick or thin the supporting bone and gingival soft tissues are defined.

Becker and Oschenbein classified three distinct types; pronounced scalloped, scalloped, and flat.³ A thin periodontium will be pronounced scalloped or scalloped. A thick periodontium will present with flat gingival architecture, and usually be supported by thick buccal and lingual plates of alveolar bone. A thin skeletal pattern with scalloped architecture will have root dehiscence and fenestrations even in a healthy periodontium (**FIGURES 1A-B**).

Periodontal soft tissues should also be evaluated for the presence of bleeding on probing and, if present, the extent and type of exudates should be noted. The presence and distribution of deposits, such as plaque, calculus, and stain should also be recorded.

If periodontal disease is present, it is important to establish the attachment level (probing depths and gingival recession) as well as any contributing factors such as mucogingival problems (lack of keratinized attached tissue and frenum involvement) and furcation involvement, which will alter the prognosis of the teeth. It is critical to measure not only probing depths and attachment levels, but to identify the level of the crestal alveolar bone by "sounding to bone." This is extremely important in the esthetic zone, when considering restorative margin placement and future implant placement.⁴

Esthetic Parameters and Treatment Options

In the esthetic zone it is extremely important to identify the position of the midline, and the amount of teeth and the soft tissues visible not only from the

TABLE 1

Esthetic Keys

- Midline
- Incisal edge position
- Incisal plane/smile line
- Occlusal plane
- Gingival level

frontal view but also from the lateral view, both with the lip at rest and when smiling. Uneven gingival architecture, the position of teeth relative to the arch shape and opposing occlusion will all affect and dictate the decision-making process. The position of the incisal edge relative to facial proportions and lip dynamics is critical (**FIGURE 2 AND TABLE 1**).

It is important to identify the problems that will affect the desired esthetic outcome.

Esthetic periodontal defects include:

- Residual gingival/periodontal defects
- Violations of biologic width
- Gingival asymmetries
- Inadequate amount of gingiva
- Gingival recessions
- Deficient pontic areas
- Frena impinging on the gingival margin

- Excessive gingival display
- Deficient interproximal papillae

Proper gingival esthetic involves initially the restoration of periodontal health. The ultimate goal of periodontal therapy is to preserve the natural dentition, periodontium, and peri-implant tissues in health, comfort, esthetics,



FIGURE 3A. Soft tissue inflammation due to overcontoured restorations.



FIGURE 3B. Soft tissue resolution after initial therapy and placement of provisional restorations with ideal contours (Courtesy of Carol Lam, DDS).



FIGURE 4. Violation of biologic width (gingival attachment) with inflammatory soft tissue response.

and function.¹ Treatment of periodontal diseases typically consists of initial nonsurgical debridement followed by re-evaluation, during which the need for additional treatment is evaluated.

Gingival and/or Periodontal Defects

Conventional nonsurgical treatment of periodontal disease consists of mechanical tooth debridement both supra and subgingivally along with instruction in proper home care methods (**FIGURES 3 A-B**). The primary objective of debridement, i.e., scaling and root planing (SRP) is to restore periodontal health by removing pathogenic products that induce inflammation (i.e., plaque, calculus, and endotoxin) from periodontally involved root surfaces. Scaling and root planing may also alter the microbial composition to a flora more compatible with periodontal health. However, patient cooperation is paramount. Subgingival debridement without adequate oral hygiene measures results in a limited response.⁵⁻⁷

While the primary objective of debridement is to remove pathogenic products, there are numerous difficulties with achieving this task. Difficulties with adequate debridement include difficulty with access and visualization, no definitive end point, and operator experience. Sites with deep periodontal pockets, grooves, furcations, and concavities are difficult to access with periodontal instrumentation and thus periodontopathic bacteria may remain in those sites.

Other obstacles have to do with the bacteria themselves. The authors' current view of bacteria is that of a biofilm.⁸⁻¹⁰

According to this concept, bacteria do not exist as free-floating bacteria, but as attached bacteria in biofilms. Bacteria in biofilms have a unique position in that they develop a synergistic relationship, cooperate with each other, and form protective barriers of exopolysaccharides. In addition, biofilm bacteria are relatively inactive metabolically and exert more resistance to antibiotics than free-floating bacteria and are thus more difficult to eradicate. Subgingival plaque in biofilm can evade the defense mechanisms of the host and diminish the effect of chemotherapeutic agents.

As a result of the difficulties described above, conventional mechanical root debridement does not usually eradicate all pathogenic bacteria from the subgingival ecosystem.¹¹⁻¹³ As a result, some propose that patients receive antibiotics at the time of hand scaling and root planing. This blanket use of antibiotics is not necessary for most patients because they usually respond well to nonsurgical treatment without antibiotics. In addition, it has been shown that without the proper removal of subgingival deposits, the use of subgingival medicaments is not useful.¹⁴

Furthermore, recent studies have concluded that surgery may provide a better long-term outcome with less need for adjunctive treatments. Long-term treatment of patients with nonsurgical therapy with or without antibiotic therapy may result in a situation that even surgery is not designed to correct. Most forms of periodontal surgery achieve best results in the early to moderate severities of disease.

In the esthetic zone, it is sometimes better to make compromises and understand that residual pocket depths may be maintainable. Nonsurgical therapy can keep interproximal papilla intact and is more desirable as compared to the esthetic problems associated with pocket elimination and the creation of "black triangles."

Not all patients respond well to therapy nor are able to maintain a healthy periodontium over time. Factors contributing to a less than optimal result usually include poor compliance with oral hygiene regimens and failure to return for regular maintenance care. Inadequate debridement may account for some treatment failures or reinfection, however, the presence of systemic conditions or local risk factors may also have a significant impact on the success or failure of treatment. Occlusal trauma, deep inaccessible pockets, overhangs, and poor crown margins can also contribute to recurrent disease.

Over the past few years, much has been learned about the relationship between risk factors and the development and progression of periodontal disease. Studies have identified smoking, diabetes, stress, genetic factors and behavioral issues as possible risk factors for periodontal disease.¹⁵⁻¹⁹ In noncompliant patients, those who smoke, or have diabetes can prove challenging to treat.

Violations of Biologic Width

The biologic width is defined as the dimension from the crest of the alveolar bone to the base of the sulcus, which includes the combined width of the con-

nective tissue and epithelial attachment²⁰ (FIGURE 4). His dimension was measured at 2.04 mm by Gargiulo and colleagues.²¹ It is important to keep in mind this dimension is an average of a range of attachment heights and does not necessarily reflect any one clinical situation. Also, there are several variations in dimension of the biologic width between individuals as well as within the same person, depending on the location of the tooth in the dental arch.²²

Vacek et al. demonstrated that some individuals have an average biologic width of 0.75 mm, whereas others have an average of 4.3 mm. The human variability of the biologic width makes it difficult for the restorative dentist to work with each component of the dentogingival complex (DGC). Kois measured the total DGC in 100 healthy patients with the free gingival margin at or coronal to the cementoenamel junction (CEJ) of unrestored anterior teeth. Based on his clinical findings, the total DGC was classified in normal crest, high crest, and low crest. Eighty-five percent of patients had a normal crest relationship where the gingival margin was located 3 mm from the osseous crest; 2 percent had a high crest with the FGM located less than 3 mm from the osseous crest; and 13 percent had a low crest with the FGM located more than 3 mm from the FGM (TABLE 2).

Once a tooth is prepared apical to the base of the sulcus, and the margin of a restoration is placed into the biologic width, specifically the connective tissue attachment, the biologic width is violated and the long-term gingival health is compromised.

Low crest DGC are susceptible to recessions, whereas high crest DGC are at risk for biologic width violation when the margin is placed more apically below the free gingival margin. Therefore, the

TABLE 2

Restorative/Periodontal Interface

	Population	Dimension of DGC	Risk when placing subgingival margins
Normal Crest	85%	= 3 mm	Minimal
High Crest	2%	< 3 mm	Biological width violation
Low Crest	13%	> 3 mm	Recession

(Modified from Kois JC, *Restorative/Periodontal Interface*.²⁸)

location of the osseous crest in relation to the gingival margin and future restorative margin is the most critical reference point for both the periodontist and restorative dentist.²³ In order to prevent a violation of the biologic width during intracrevicular tooth preparation, the authors recommend the following protocol:

1. Sound to osseous crest
2. Determine the crest relationship (normal, high, low)
3. Prepare tooth with margin position placed coronally based on osseous crest relationship, and apically 3 mm coronal to bone
4. Follow scallop of FGM prior to tissue retraction

When the biologic width is violated, the treatment options involve osseous surgery as well as orthodontic extrusion based on the location of the violation, facially, or interproximally. An apically positioned flap with osseous recontouring is indicated when the FGM can be moved apically with no aesthetic compromise or when the violation only involves the facial line angles. It is important to determine which osseous crest relationship the patient presents with prior to surgery in order to position the FGM of the flap at the proper location in relation to the osseous crest. The biologic width will re-establish to its original vertical dimension by six months following surgery.²⁴

The marginal periodontal tissues show a tendency to grow in a coronal direction when the biotype is thick.²⁵ Therefore, definitive crown preparation

should not be made for at least three months after surgery, and sometimes when the periodontal biotype is thin, not before six months.²⁶ After surgery, it is even more important for the restorative dentist to use the osseous crest as a reference point during crown preparation, and to always follow the scallop of the free gingival margin.

When the biologic width violation involves the interproximal tissue, the tooth can be extruded out of the periodontium exposing sound tooth structure.²⁷ Gingival fiberotomy is performed every week in order for the tooth to move out of the alveolar housing. The tooth should be stabilized for a least 10 to 12 weeks, and the final bone and soft tissue position should be evaluated for any additional flap and osseous surgery.

In conclusion, the biological width must be carefully evaluated prior to any restorative and periodontal procedures, keeping in mind that the average dimension of 3 mm does not apply to all patients.

Gingival Asymmetries

Horizontal gingival symmetry is defined as the position of the gingival margins of the central incisors and canine bilaterally situated 1 mm above the gingival margins of the lateral incisors²⁹ (FIGURES 5A-D).

The cause of gingival asymmetries of the maxillary incisors and canines include wear combined with compensatory eruption, altered active eruption, altered passive eruption, trauma at an early age preventing normal tooth

eruption, drug-induced gingival overgrowth, gingival hyperplasia due to local irritants like orthodontic bands and brackets, tooth position (facially or palatally), and root prominence.³⁰

Treatment options for uneven gingival symmetry include:

1. Orthodontic extrusion with periodontium³¹
2. Orthodontic intrusion³²
3. Soft tissue grafting for root coverage³³
4. Surgical crown lengthening³⁴

These treatment modalities can be accomplished simultaneously in order to obtain the ideal gingival esthetic.

GINGIVAL RECESSIONS, INADEQUATE AMOUNT OF GINGIVA, ABERRANT FRENA, AND DEFICIENT INTERPROXIMAL PAPILLAE

Gingival recessions are due to either periodontitis, or to mechanical factors, primarily toothbrushing³⁵ (FIGURES 6A-B). Recession due to horizontal attachment loss (periodontitis) affects all tooth surfaces and is irreversible, whereas facial recession is reversible with periodontal reconstructive procedures.³⁶ Complete coverage of facial recession defects can be achieved only when there is no interproximal loss of bone. Miller described a classification of recession defects, taking into consideration the anticipated root coverage that is obtainable³⁷:

■ **CLASS I.** Marginal tissue recession not extending to the mucogingival junction. No loss of interdental bone or soft tissue.

■ **CLASS II.** Marginal tissue recession extends to or beyond the mucogingival junction. No loss of interdental bone or soft tissue.

■ **CLASS III.** Marginal tissue recession extends to or beyond the mucogingival junction. Loss of interdental bone or soft tissue is apical to the cemento-enamel junction, but coronal to the apical extent of the marginal tissue recession.



FIGURE 5A. Gingival asymmetry.



FIGURE 5C. Gingival asymmetry. Note missing No. 7 with cuspid in lateral incisor position.



FIGURE 6A. Marginal tissue recession with esthetic concerns.

■ **CLASS IV.** Marginal tissue recession extends beyond the mucogingival junction. Loss of interdental bone extends to a level apical to the extent of the marginal tissue recession.

ROOT EXPOSURE

Complete root coverage can be achieved with class I and II defects, while only partial coverage can be expected in class III recessions. No root coverage can be obtained in class IV defects. A recent meta-analysis showed that the subepithelial connective tissue graft is a highly effective procedure for covering gingival recessions as well as increasing the amount of keratinized tissue.³⁸



FIGURE 5B. Crown lengthening surgery was performed prior to placement of new restorations (Restorations: Ken Ho, DDS).



FIGURE 5D. Final restorations after crown lengthening surgery (Restorations: Abdi Sameni, DDS).



FIGURE 6B. Soft tissue grafting was performed with successful root coverage.

Studies show a mean defect coverage ranging from 57 percent to 98 percent with a mean for all studies of 84 percent.³⁹ Wennstrom et al. showed improved results with recession defects less than 5 mm, as compared to sites with greater than 5 mm attachment loss.³⁹

The subepithelial connective tissue graft technique involves a split thickness flap technique. The graft is harvested on the palatal aspect of the maxillary premolars or from the retromolar pad by the use of a “trap door” approach, and stabilized with sutures over the recession defects. The coronally positioned envelope flap is sutured to cover as much of the graft as possible.^{40,41}

When a tooth presents with a lack of quantity (< 2 mm) and quality (thin) of gingiva, the placement of a subgingival restorative margin may, in the presence of subgingival plaque, induce an inflammatory reaction, which results in an apical displacement of the gingival margin.⁴²

Furthermore, when orthodontic tooth movement is planned in a labial position, there is a risk of alveolar bone dehiscence.⁴³ To prevent any further recession, the thickness of the gingival margin has to be improved as well as the tissue height with either a connective tissue graft or thick free gingival graft technique.

FRENA

A hyperplastic frenum can obstruct diastema closure, and should be relocated. The frenectomy has been the most common surgical procedure to remove a frenum. With the frenectomy, the attachment of the frenum to gingiva and periosteum is severed, and the insertion of the frenum is relocated several millimeters up onto the alveolar mucosa.⁴⁴

DEFICIENT INTERPROXIMAL PAPILLAE

There are several causes for the loss of papilla height and the presence of "black triangles." The most common reason is chronic periodontitis; however, abnormal tooth shape, improper proximal contours, and traumatic oral hygiene procedures can cause black spaces. There are no predictable surgical procedures at the present time to augment a papilla. Orthodontic treatment options including extrusion, paralleling of the roots of adjacent teeth, and mesiodistal enamel stripping can help minimize black triangles.⁴⁵ Restorative options, including direct as well as indirect restorations, can change the gingival embrasure form of the tooth by moving the interproximal contact toward



FIGURE 7A. Ridge collapse with class III defect (frontal view).



FIGURE 7C. Ridge collapse with class III defect (occlusal view).



FIGURE 7B. Final implant supported restorations following ridge augmentation (Restorative dentist: Seon Ha, DDS).



FIGURE 7D. Ridge augmentation following implant placement for improved gingival architecture.

the papilla and closing the black space.

Deficient Pontic Areas

Following extractions of anterior teeth, there is always a certain amount of bone resorption. Abrams et al. have shown that the loss of anterior teeth resulted in 91 percent of ridge deformities⁴⁶ (FIGURES 7A-D; TABLE 3). The most prevalent defect was a combination labiolingual and apicocoronal type of deformity. According to Siebert, ridge defects are classified into three different classes⁴⁷:

- **CLASS I.** Loss of buccolingual width but normal apico-coronal height

- **CLASS II.** Loss of apico-coronal height but normal buccolingual width

- **CLASS III.** A combination of loss of both height and width of the ridge

If the prognosis of teeth is deemed hopeless due to periodontal, endodontic or nonrestorability factors, then anticipating the amount of future ridge collapse needs to be estimated. In this case, it is extremely important to identify the tissue biotype and the underlining missing bone, which will help determine the prognosis and steps necessary to preserve or rebuild

the desired soft and hard tissue architecture after tooth loss. Thick tissue is much more forgiving, easier to manipulate and provides a more predictable esthetic outcome, as compared to thin tissue, which is more likely to shrink. Deciding when to extract a tooth is easy when it is hopeless, but often times more heroic attempts to save teeth that are broken down with a questionable prognosis is not as simple. In order to preserve the alveolar bone for implants, sacrificing teeth (early extraction) requires a change of thinking as compared to previous philosophical treatment decisions.

Ridge augmentation procedures should be carefully planned in close consultation with the restorative dentist in order to obtain an optimal esthetic outcome. Prior to initiating the treatment, the following factors should be determined:

- Amount of tissue required to eliminate the ridge deformity
- Type of graft procedure to be used
- Timing of various treatment procedures
- Design of the provisional restoration

TABLE 3

Ridge Augmentation Procedures

Technique	Indications	Contraindications	Advantages	Disadvantages
Pedicle graft	Mild cl I defect	Insufficient palatal donor tissue available	One surgical site	Limited tissue available
Subepithelial connective tissue graft	Mild cl I, II, III defect		Multiple augmentation possible; stable after shrinkage	Remote surgical site; limited amount of tissue available; shrinkage for the first 6 weeks
Full-thickness onlay graft	Moderate to severe cl II and III defect		Multiple augmentation possible; stable after shrinkage	Remote surgical site; limited amount of tissue available; color match
Soft and hard tissue graft	Severe cl I, II, III defects		Unlimited bio-material available	Requires primary closure

The authors recommend that the provisional be made prior to surgery and the provisional restoration should be a blueprint of the final restoration meeting the esthetic guidelines previously described in the article. It is the responsibility of the periodontist to augment the ridge to meet the provisional prosthesis in the most exact manner possible. Ridge augmentation treatment options include:

1. PEDICLE GRAFT PROCEDURES:

- Roll flap procedure⁴⁸
- Pediculated connective tissue graft⁴⁹

2. FREE GRAFT PROCEDURES:

- Pouch graft procedure⁵⁰

- Interpositional graft procedure⁵¹

- Onlay graft procedure⁵²

3. GUIDED BONE REGENERATION PROCEDURES⁵³

4. COMBINATION OF SOFT AND HARD TISSUE AUGMENTATION

The use of pedicle graft procedures is indicated for correction of a single tooth ridge defect with minor horizontal and vertical loss, whereas in cases of larger defects free graft procedures should be chosen. The onlay graft procedure is indicated primarily for large class II and class III defects in the presence of mucogingival problems includ-

ing lack of gingiva in width as well as high frenum attachment and tattoo.

Severe defects are corrected with a combination of soft and hard tissue augmentation procedures including guided tissue regeneration.

Excessive Gingival Display

Often, patients will seek treatment with a periodontist to correct their gummy smiles (**FIGURES 8, 9A-B, 10A-F; TABLES 4 AND 5**). It is important that the proper diagnosis be formulated in order for the periodontist to obtain a successful treatment outcome. Sixty-nine percent of the population has an average smile line, which limits the amount of gingiva that can be seen when a person smiles. Eleven percent of patients have a high smile line, which exposes a significant amount of gingiva.⁵⁴

Treatment options for the correction of excessive gingival display (EGD) should be based on a careful analysis of the dentofacial structures, and include surgical crown lengthening, orthodontics, and orthognathic surgery. The differential diagnosis of EGD should incorporate the following features:

1. Short upper lip
2. Hypermobile lip
3. Vertical maxillary excess (**FIGURE 8**)
4. Anterior overeruption
5. Wear and compensatory eruption



FIGURE 8. Vertical maxillary excess showing healthy periodontium with symmetrical gingival contours. If the patient wants correction, then orthognathic surgery is required.



FIGURE 9A. Average smile line showing short clinical crowns with altered eruption.



FIGURE 9B. Smile following combination of treatment including surgical crown lengthening, orthodontic movement to close the diastema and bonding restorations.



FIGURE 10A. Presurgery: Altered eruption with uneven gingival contours.



FIGURE 10B. Preosseous view of altered eruption. Note level of osseous crest relative to CEJ.



FIGURE 10C. Postosseous surgery.



FIGURE 10D. Initial postop: One week healing.



FIGURE 10E. Final result after crown recontouring and restorative bonding (Restorative dentist: Robert Wheeler, DDS).



FIGURE 10F. Final smile.

6. Altered active eruption

7. Altered passive eruption

If EGD is due to insufficient length of the clinical crowns, it is important to evaluate if the teeth present any wear. When the incisal edge is worn, the diagnosis is compensatory eruption.⁵⁵ The treatment consists of orthodontic intrusion if the roots are short, and/or surgical crown lengthening when the roots have a normal length.

If the teeth have no wear, the diagnosis is either altered passive or altered active eruption.⁵⁶ In altered active eruption, the crest of bone is at the level of the CEJ, the anatomical crown having not fully erupted out of the alveolar bone. Usually the periodontium is of the thick biotype combined with a bony ledge. The treatment should consist of an apically positioned flap with osseous recontouring. In altered passive eruption, the alveolar crest has a normal relationship with the CEJ, but the gingiva does not recede normally, leaving a short clinical crown. The periodontium might be of a thin biotype, and full exposure of the anatomical crown can be accomplished sometimes with a gingi-

vectomy, and sometimes with an apically positioned flap with ostectomy, depending on the amount of gingiva present.

In other individuals who have excessive display of gingiva with normal size and shape of the teeth, and the location of the gingival margins is perfectly normal, the EGD is often caused by the following: short upper lip, hypermobile lip, vertical maxillary excess, anterior overeruption.

If there is excess tooth display at rest, and the person presents normal facial proportions, and the upper lip is short (<22 mm), no treatment can correct the gummy smile. If the tooth display at rest is normal and is combined with excessive gingiva visible anteriorly and posteriorly while smiling, and the facial proportions are normal, the diagnosis is hypermobile lip. Consultation with a plastic surgeon to augment or reposition the lip can be of benefit to correct the EGD due to a hypermobile lip.

If there is excessive gingival tooth display at rest, and the person presents a long midface, the diagnosis is vertical maxillary excess. Periodontal surgery will not correct the problem,

but rather the maxilla must be impacted by orthognathic surgery.

When the excessive gingival display is located only anteriorly, it is due to a class II malocclusion combined with anterior overeruption. The treatment includes orthodontic intrusion as well as surgical crown lengthening and restorative dentistry.

Conclusion

Periodontal therapy is an extremely important part of all of our patients oral health. Establishing a logical treatment plan can only occur if the initial diagnosis is correct. The diagnosis will lead to a prognosis for each tooth and the overall dentition. After completion of active periodontal therapy, it is important to create a healthy periodontium that can be maintained with ideal home care and regular recall (periodontal maintenance) appointments. In the esthetic zone it is important to understand all the factors that affect the smile and that relate to uneven gingival contours (asymmetry). Establishing the ideal smile requires careful selection of the appropriate procedures prior to placement of restora-

TABLE 4

Condition, Etiology, and Clinical Findings for EGD

Condition	Etiology	Clinical Findings
Altered passive eruption	FGM fails to recede to the level of the CEJ during tooth eruption	FGM located incisal to the CEJ
Altered active eruption	Osseous crest fails to resorb 2 mm apical from CEJ	FGM located incisal to the CEJ
Wear and compensatory eruption	Pathologic attrition, erosion	FGM located at the level of the CEJ
Vertical maxillary excess	Skeletal, developmental	Long midface combined with EGD Normal clinical crown length
Short upper lip	Length of lip < 22 mm	EGD Normal clinical crown length
Hypermobile lip	Muscular capacity of orbicularis oris to raise the upper lip higher than average	EGD anterior and posterior while smiling Normal facial proportions Normal clinical crown length
Anterior overeruption	Class II malocclusion	EGD only anterior while smiling Normal clinical crown length

TABLE 5

Treatment Modalities for EGD

	Short Lip	Hypermobile Lip	VME	Anterior Overeruption	Wear and Compensatory Eruption	Altered Active Eruption	Altered Passive Eruption
Periodontics				●	●	●	●
Orthodontics				●	●		
Orthognathic surgery			●				
Plastic surgery	●	●					

tions. Often this requires a coordinated effort between the restorative dentist and the other specialists. ■■■■

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TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE CONTACT Nicolas Ravon, DDS, MSD, 3808 Riverside Drive, Suite 305, Burbank, Calif., 91505.



Integrating Orthodontics for the Optimal Smile

FRANK K. YORITA, DDS

ABSTRACT With the rapid and complex advancements in materials and technology in dentistry today, it has become difficult for the dental practitioner to stay current in one field, let alone more than one. In order to increase patient benefits and decrease the dentist's frustration, today's dental practice requires an interdisciplinary approach that integrates the knowledge, skills, and experience of all the disciplines of dentistry and its associated fields. This article highlights the advantage of an interdisciplinary treatment approach and how knowledge of basic orthodontic techniques can help in producing a more comprehensive treatment plan.

AUTHOR

Frank K. Yorita, DDS, FICD, FACD, is a board-certified orthodontist who has maintained a private practice in Orange County for 36 years. He is a guest lecturer at Nihon University Dental School, Tokyo, Japan, and he has been a clinical assistant professor at the University of Southern California, School of Dentistry for 16 years and is a founding member of the Interdisciplinary Dentofacial Institute.

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There has been a tremendous change in the orthodontic decision-making process in the last half century. Through the 1960s, the orthodontist was the undisputed team captain, and usually made all the decisions regarding occlusion and tooth position. In the 1970s and 1980s, the orthodontist worked closely with the oral surgeons as more adults sought treatment and orthognathic surgery became more common. Even then, the orthodontist made most of the decisions based on cephalometric analysis (**FIGURE 1**) and the angle paradigm, namely, class I occlusion.¹

In the 1990s, the orthodontist had to rely more on input from other disciplines within the profession to conceive, formulate and complete more sophisticated

treatment plans: a multidisciplinary treatment approach with specialists performing in their own spheres² (**FIGURE 2**).

Besides the aging of the baby boomers and their desire to maintain their youth, the general public's interest in self-improvement and physical beauty has increased significantly.

Any treatment that is dedicated to enhancing human esthetics is complex. Mainly for this reason, the 21st century has seen treatment evolve beyond a multidisciplinary effort to an interdisciplinary, interdependent team effort, with the primary players in this interdisciplinary team approach being the endodontist, periodontist, oral surgeon, orthodontist, and restorative dentist (prosthodontist). The pedodontist is also called upon as the need arises² (**FIGURE 3**).

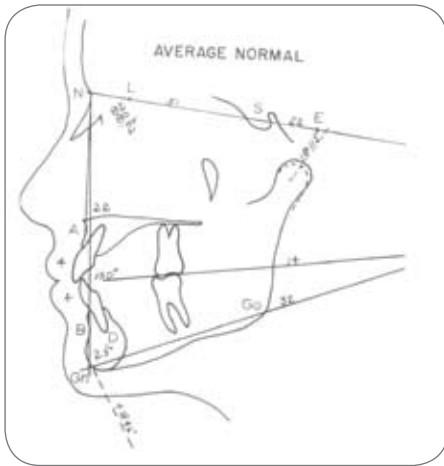


FIGURE 1. Steiner Analysis. Line NS (nasion-sella) represents the stable cranial base. Angle SNA represents the horizontal position of the maxilla and SNB the horizontal position of the mandible. Angle ANB represents the difference. The average normal value for ANB is 2. A higher value indicates a protrusive maxilla or class II skeletal relationship. A lower value indicates a class III. The mandibular plane angle (GoGnSn) value is 32. A higher value indicates a skeletal open bite tendency and a lower value a deep bite tendency.

Facial Beauty and Balance

Achieving both excellent occlusion and esthetics is difficult, but with the patient's approval, it's the goal to which dentists should all strive. To treat only the occlusion treats only half the patient. Treating only for esthetics (aligning or restoring only the anterior teeth) also treats half the patient. Putting equal effort and thought into enhancing appearance and occlusion helps promote our patients' well-being on many levels, both functionally and esthetically.

To encompass both function and esthetics, Dr. David Sarver's classification of appearance and esthetics is often used³ (**FIGURE 4**).

The classification of appearance and esthetic analysis is comprised of three components: macro-, mini-, and microesthetic divisions. The functional goals of occlusion remain in place but are evaluated in the context of an expanded dentofacial analysis.

This model provides a framework for systematic evaluation of the esthetic needs of each particular patient. It is a departure from the traditional approach to orthodontic diagnosis and treatment planning based almost exclusively on models and cephalometric numbers. Instead, it focuses the orthodontist on the clinical examination of the patient both at rest and smile animation, and in all three physical dimensions. The emphasis is not so much on linear and angular norms but is on appropriate proportionality of facial features.

Early Screening

The orthodontist must be especially aware of dentofacial, developmental, and restorative options for esthetic and functional corrections. The orthodontist has the unique opportunity to provide early recognition of developmental facial and occlusal problems and initiate correc-

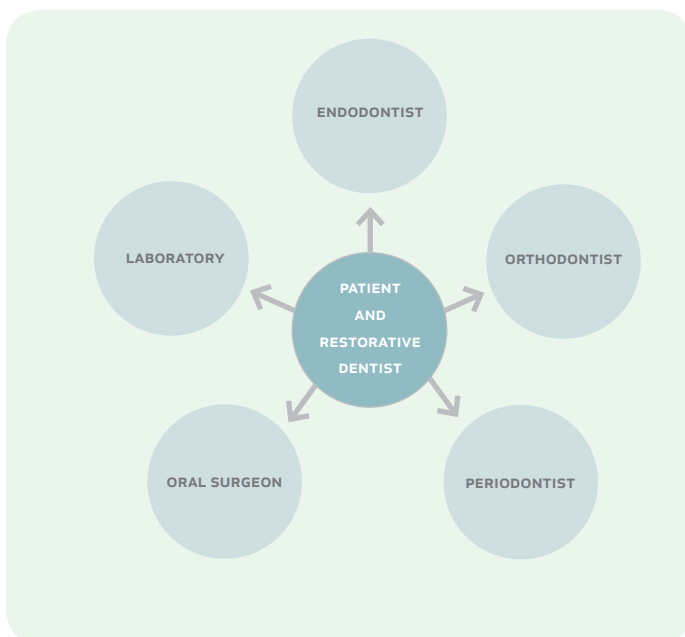


FIGURE 2. Multidisciplinary treatment approach.

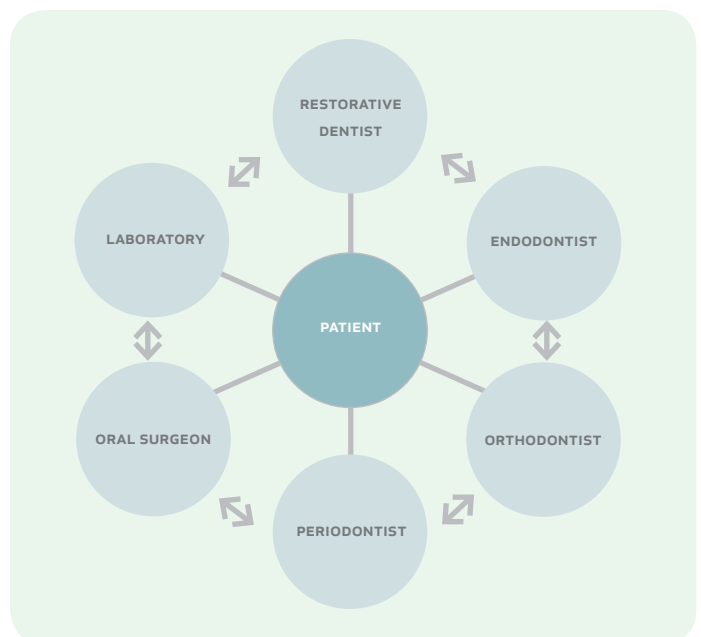


FIGURE 3. Interdisciplinary treatment approach.



FIGURE 4. Sarver's classification of appearance and esthetics.

tive measures that may prevent unnecessary extractions, orthognathic surgery, or extensive restorative therapy. This can only happen by educating the public on the importance of an orthodontic screening between 7 and 8 years of age, and, if appropriate, referrals to the orthodontist by the general dentist are enacted (**FIGURES 5A-C**: early expansion for nonextraction results; **6A-B**: orthopedic appliance for excessive overjet; and **7A-B**: open bite).

The Surgical Connection

Once growth is complete, achieving facial balance and proper function becomes more complex. Orthognathic surgery must be included in a comprehensive treatment plan and the oral surgery team must work closely with the orthodontist.

The following interdisciplinary case shows facial imbalance due to the lack of development of the lower third of the face (**FIGURE 8A**). This hypoplastic condition also makes the nose seem large. The treatment decision was to extract two lower bicusps to relieve the crowding, nonextraction on the



FIGURE 5A. Progress Panorex showing upper expansion appliance in place and prior to placing lower fixed expansion appliance. Note the amount of arch discrepancy.

maxilla to preserve lip support, then surgical advancement of the maxilla, mandible, and chin. The results show a more pleasing profile without the need for rhinoplasty since the tip of the nose came forward with the advancement of the maxilla and the midface no longer seems prominent relative to the lower third of the face. The occlusion functions well with molars in angle class III and the

cusps in class I (**FIGURE 8B**). **FIGURE 8C** shows the patient 15 years after completion of treatment. Note the stability of both the occlusal and surgical results.

The patient in **FIGURE 9A** has a class III malocclusion. Most clinicians would consider doing a mandibular set-back surgery. However, close examination of the patient's profile reveals a lack of

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FIGURE 5B. Initial banding after expansion appliances removed.



FIGURE 5C. Case completed after phase I expansion and full banded phase II treatment. What would extractions have done to her profile?



FIGURE 6A. Mixed dentition case with a 12 mm overjet and retrusive profile.



FIGURE 6B. Final results after phase I treatment with a fixed orthopedic appliance (Herbst) and phase II full banding.



FIGURE 7A. Open bite case in mixed dentition



FIGURE 7B. Final results after phase I treatment with a removable orthopedic appliance (Bionator) and full banded phase II.



FIGURE 8A. Facial imbalance due to lack of development of the lower third of the face.



FIGURE 8B. The results show a more pleasing profile. The occlusion functions well with molars in angle class III and the cuspids in class I.



FIGURE 8C. The patient 15 years after the completion of treatment.

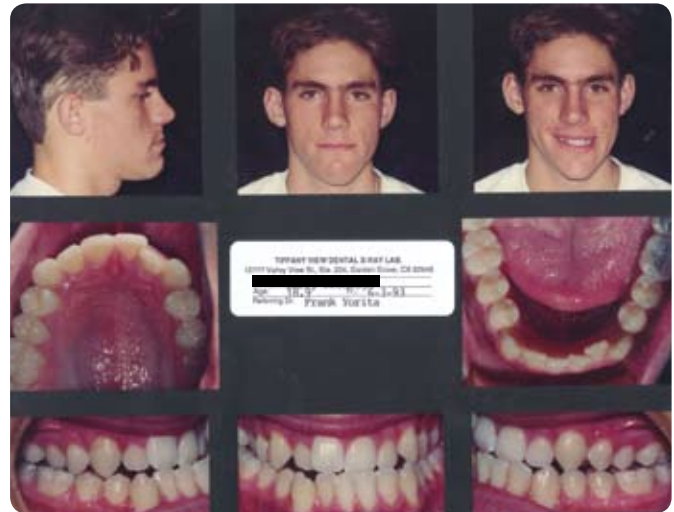


FIGURE 9A. Class III malocclusion.

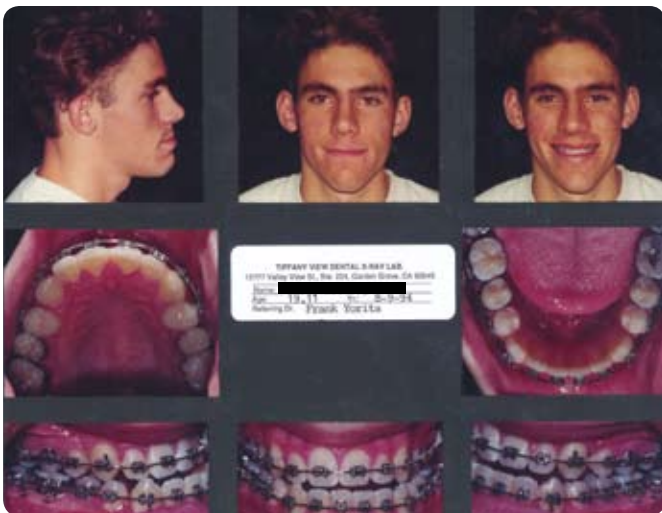


FIGURE 9B. The surgical treatment decision was to do a "high LaForte" surgery and advance the maxilla and malar bone after initial orthodontic alignment.



FIGURE 9C. The results produced a more balanced face with an ideal class I occlusion.

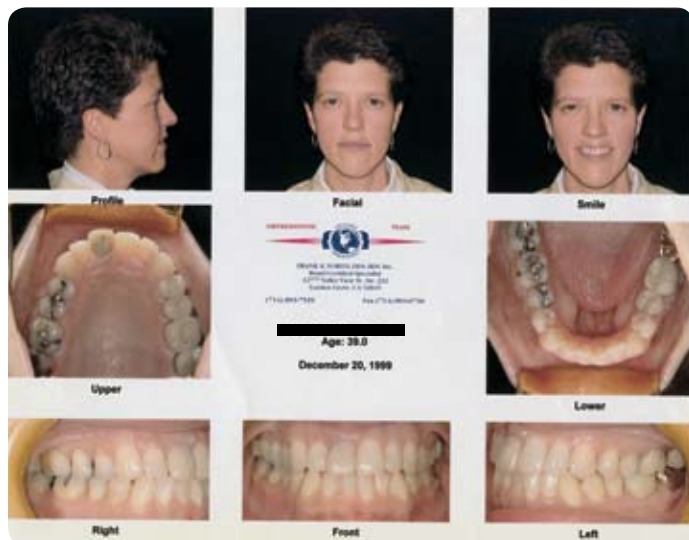


FIGURE 10A-1.



FIGURE 10A-2.

FIGURE 10A. Forced eruption: This patient had labial caries on No. 8 that extended to the alveolar crest. In order to preserve the biological width and follow the rule of ferrule, No. 8 had to be extruded by at least 4 mm.

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development of the midface and weak “cheek” bones (malar eminences). The surgical treatment decision was to do a “high LaForte” surgery and advance the maxilla and malar bone after initial orthodontic alignment (**FIGURE 9B**). The results produced a more balanced face with an ideal class I occlusion (**FIGURE 9C**).

The Restorative Connection

The orthodontist’s contribution to the esthetic team effort is often in tooth positioning and site preparation. Teeth may need to be aligned in the ideal position for the final restoration. The following are some case examples of preresorative orthodontic treatment: forced eruption: **FIGURES 10A-C**; molar uprighting: **FIGURES 11A-C**; root position for implant: **FIGURES 12A-B**.

Comprehensive Treatment Interactions

The following is a summary of what orthodontic treatment can do to help provide a more comprehensive treatment result:

- Incisor crowding elimination to harmonize interarch alignment style, with or without upper anterior veneers
- Optimal teeth positioning before veneer placement
- Creating better papilla form through space closure and root alignment
- Nonsurgical leveling of gingival scallops

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FIGURE 10B-1.

FIGURE 10B. Incisal edge was reduced as tooth was extruded. Periodontal surgery (crown lengthening) was done after eight weeks of stabilization and maturing of the bone.



FIGURE 10B-2.



FIGURES 10C-1.

FIGURE 10C. No. 8 is restored after waiting eight weeks for the gingiva to completely heal. Gingival contour is re-established. Note amount of extrusion verified in the radiographs.

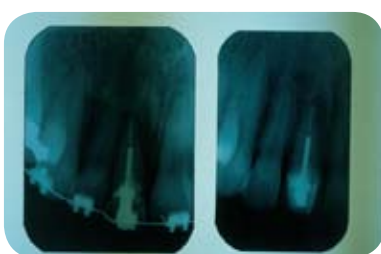


FIGURE 10C-2.

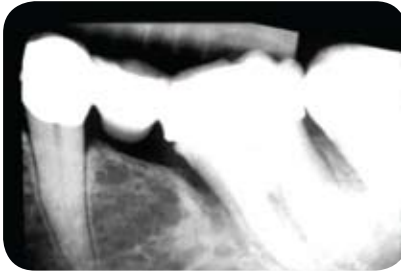


FIGURE 11A. Poor prognosis due to restoring a tipped molar.

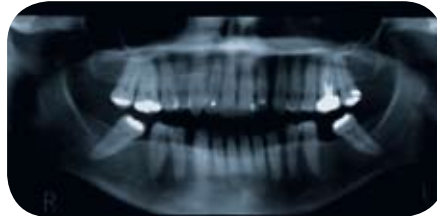


FIGURE 11B-1.



FIGURE 11B-2.

FIGURE 11B. Nos. 18 and 31 were orthodontically uprighted to create space for wide body implants. Vertical bony defects were also eliminated.



FIGURE 11C-1.

FIGURE 11C. Before and after treatment photos show that orthodontic treatment uprighted Nos. 18 and 31 and corrected the malocclusion.



FIGURE 11C-2.



FIGURE 12A-1.



FIGURE 12A-2.



FIGURE 12A-3.

FIGURE 12A. Radiographs show bonded fixed partial dentures replacing Nos. 7 and 10. No room for implants. Note No. 8 bracket position to allow for more mesial root tip.

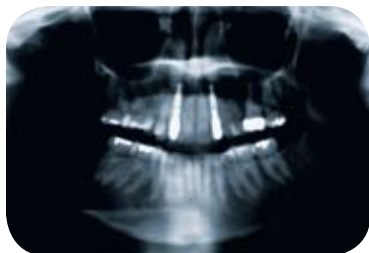


FIGURE 12B-1.



FIGURE 12B-2.

FIGURE 12B. Implants are restored, and No. 8 is veneered.



FIGURE 13. Self-ligating bracket.



FIGURE 14. Temporary anchorage device or miniscrew.

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- Periodontal pocket reduction by uprighting tipped teeth
- Forced eruption of a tooth following fracture or extensive caries to help preserve the biological width and provide more tooth structure before restorative care
- Eruption of tooth roots to level bone before extractions (when anticipating implant placement) that provides essential gingival support for interdental papilla and facial scallop
- Improving lip support by maxillary incisor angulation if they are in lingual version

Latest in Orthodontic Therapy

Self-ligating Braces (FIGURE 13)

Dwight Damon, DDS, a Washington state orthodontist, reintroduced the self-ligating or tie-less orthodontic bracket and created enough interest that all the large orthodontic supply companies now have their own brand. These brackets have a slide that holds the arch wire in place rather than using an elastomeric or metal ligature tie. This significantly reduces the friction between the bracket and wire, and allows the teeth to move

more rapidly. The new space-age, thermally activated memory wires are able to work more efficiently with lighter physiologic forces when these self-ligating brackets are used. Because of this feature, appointments for patients can be extended between eight to 10 weeks rather than the traditional four to six weeks and treatment time is often reduced.

Invisalign

This brace-less method of treating patients has become very popular with adults because of its cosmetic advantage and the amount of advertising done by the Align Company. However, as compared to traditional brackets, the Invisalign trays are not as efficient in correcting large rotations, uprighting roots, and extruding teeth. Development of various-shaped attachments (composite buttons) has helped with these movements but ideal results are still difficult to achieve, especially with posterior teeth. Often, traditional brackets have to be placed to complete the more complex cases.

Temporary Anchorage Device (TAD or Miniscrew) (FIGURE 14)⁴

Most of the clinical research on TADs was done in Europe and Asia since the FDA did not give approval for these modified surgical bone screws to be used in orthodontic treatment until May 2005. TADs are mechanically held in place and do not become osseointegrated. However, the stability gained from the cortical bone allows for intrusion, extrusion, protraction, retraction, and uprighting of teeth without the need for patient cooperation or loss of anchorage (other teeth moving in an undesirable direction). Placement and removal of these mini-screws can be done painlessly with a deeply penetrating topical anesthetic. The most popular TADs are self-drilling, 1.5

millimeters in diameter and 8 millimeters in length. Various sizes and head shapes are available depending on the need.

Accelerated Osteogenic Orthodontics (AOO)

Currently this technique is not widely accepted or used; however, clinical studies are being conducted in the dental schools at St. Louis University, Boston University, and University of Southern California.⁵⁻⁷

Accelerated osteogenic orthodontics is a revived treatment method that combines selective alveolar decorticating, alveolar augmentation, and orthodontic treatment. Prior to starting orthodontic mechanotherapy, gingival flaps are laid and corticotomy surgery is performed by the periodontist. The surgical wounding of the osseous tissue causes a cascade of physiologic healing events called regional acceleratory phenomenon.⁸ RAP is a process that involves accelerated bone turnover and decrease in regional bone density, resulting in rapid orthodontic tooth movement and decrease in treatment time by half or more.⁵ This method of accelerated osteogenic orthodontics was developed by Drs. William and Tom Wilcko.⁶

Conclusion

This article is based on the author's 38 years of orthodontic practice (including residency) and sixteen years of teaching, and is primarily experience-based rather than evidence-based. According to the editor of the *Journal of Clinical Orthodontics*, Dr. Robert Keim, "there is not a division or debate between "evidence-based" and "experience-based" practice, but rather a mutually beneficial continuum between the two philosophies ... the clinical judgment of a skilled practitioner and the patient's individual preferences and values are given equal weight with scientific evidence in the decision-making (treatment planning) process."⁹

Dr. Vince Kokich said "to provide

excellent esthetic care for your patients who have difficult dental problems, it is important to be part of an interdisciplinary treatment group."¹⁰ Working together and combining skills to achieve the optimal results for your patients can enhance patient and professional satisfaction as well as stimulate mutual referral and treatment acceptance. ■■■■

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CONTACT Frank K. Yorita, DDS, 12777 Valley View St., Suite 222, Garden Grove, Calif, 92845-2522.

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Transitioning Patients From Teeth to Implants Utilizing Fixed Restorations

SAJID JIVRAJ, DDS, MSED; MAMALY RESHAD, DDS, MSC; AND WINSTON W.L. CHEE, DDS

ABSTRACT The provisional phase of treatment can be the most challenging in implant dentistry. The choice of provisional restoration should be based on esthetic demands, functional requirements, duration, and ease of fabrication. One major obstacle to treatment with implants is the transitional phase between a tooth-supported occlusion and an implant-supported occlusion. This is of particular concern when a patient with a failing dentition has not worn a removable prosthesis before and is planned to have a reconstruction supported by implants.

AUTHORS

Mamaly Reshad, DDS, MSC, is an assistant professor of clinical dentistry, and co-chair for fixed prosthodontics and operative dentistry, Division of Primary Oral Healthcare, University of Southern California, School of Dentistry, Los Angeles.

Winston W.L. Chee, DDS, FACP, is the Ralph and Jean Bleak Professor of Restorative Dentistry; director, implant dentistry; co-director, advanced prosthodontics at the University of Southern California, School Of Dentistry, and in private practice in Glendale, Calif.

Sajid Jivraj, DDS, MSED, is an associate clinical professor, former chairman section of fixed prosthodontics and operative dentistry University of Southern California, School of Dentistry, Los Angeles, and in private practice in Oxnard, Calif.

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Implants were originally designed with the edentulous patients in mind, as well as to compensate for the poor support and retention available from the mucosa.^{1,2}

With conventional delayed loading protocols, patients receiving implants are sometimes required to wear a removable transitional prosthesis. For many patients this is unacceptable both socially and esthetically.

Achieving osseointegration is not the challenge that it seemed to be 30 years ago. Today, implant integration is a given and providing an implant-supported restoration that is in harmony with the surrounding hard and soft tissues is the goal. Bone and gingival grafting procedures are routinely used to optimize the site prior to implant placement. Removable prostheses can hamper these procedures as

pressure from removable prostheses can interfere with the proper healing of grafts.

The purpose of this article is to describe options other than removable prostheses in transitioning the patient from teeth to implant-supported restorations. Emphasis is placed on fixed transitional prostheses for the reasons described above.

Transitioning Patients From Teeth to Implants

Today's patients have high expectations regarding esthetics and providing functional restorations alone may not be sufficient to satisfy many of them. With heightened esthetic expectations, it becomes imperative the restorative dentist understand the patient's desires and expectations prior to embarking upon any irreversible therapy. Moreover,

emphasis should be placed on diagnosis and treatment planning because in most situations the proper diagnosis will dictate the appropriate treatment plan. Inadequately planned treatment and inadequately informed patients, even when well executed, will result in less-than-ideal treatment satisfaction.³

The functional and esthetic replacement of missing teeth with dental implants remains a complex task under most conditions. With comprehensive treatment planning and proper surgical and restorative protocols more predictable results can be achieved. With this in mind, transitioning the patient from teeth to an implant-supported restoration becomes even more difficult as precise planning will now include timing of extractions, method of retaining fixed provisional restorations, manipulation of remaining teeth to enhance implant receptor sites, and many other considerations. Patients almost always prefer to have a fixed prosthesis during this transition.

The rationale for fixed transitional prostheses suits both the patient and the clinician. Patient management with a fixed prostheses has the advantages of elimination of the discomfort experienced with a removable prostheses due to impingement of the mucosa, the psychological advantage of having a fixed restoration during integration of the implants, preventing transmucosal loading of the implants, and not interfering with any grafting procedures. The clinician also benefits by decreased chairtime, unscheduled visits, and reduced maintenance of the provisional prosthesis.

One disadvantage of using a fixed prosthesis in transition is the additional cost involved. However, in patients embarking upon already costly and lengthy therapy, the additional cost for comfort and convenience



FIGURE 1. An implant-supported prosthesis is planned for teeth Nos. 25 and 26. The adjacent teeth have porcelain veneers. The patient wanted to avoid a removable prosthesis in the transitional phase.



FIGURE 2. A resin-bonded fixed partial denture is a convenient way of transitioning the patient. It is entirely tooth-supported and avoids putting pressure on the implant site.



FIGURE 3. Facial view showing interim partial denture replacing teeth Nos. 7 and 9. The patient requested implant-supported restorations and was dissatisfied with the proportions of the teeth.



FIGURE 4. Facial view showing discrepancy in tooth length.



FIGURE 5. Diagnostic wax patterns from teeth Nos. 7-10 illustrating anticipated contours of final restorations.



FIGURE 6. Provisional restoration following removal of crowns on teeth Nos. 8 and 10. This provisional restoration can also function as a radiographic guide.

outweighs the social embarrassment of wearing a removable prosthesis.

There are several methods to transition a patient from teeth to implant-supported restorations, each having its own indication. The following methods will be discussed.

Options

- Resin-bonded fixed partial dentures
- Use of provisional fixed partial dentures
- Use of strategic abutments and

full-arch provisional fixed partial dentures

- Provisional implants
- Immediate loading

1. RESIN-BONDED FIXED PARTIAL DENTURES

Since the pioneering work of Rochette, there have been a plethora of techniques developed to enhance the success of resin-bonded fixed partial dentures.^{5,6} The literature indicates resin-bonded fixed partial dentures can have sustained clinical success over time and there are indications for their use as definitive restorations.⁷



FIGURE 7. Autogenous bone grafts placed in sites Nos. 7 and 9.



FIGURE 8. Provisional restoration placed back in situ. It is adjusted so all pressure is kept off the graft site.



FIGURE 9. Provisional restoration following placement of dental implants.



FIGURE 10. Definitive implant restorations on teeth Nos. 7 and 9 and metal ceramic restorations on teeth Nos. 8 and 10.

When treatment planning implant-supported restorations, these prostheses are a useful tool. They can be bonded to a single abutment tooth (**FIGURES 1 AND 2**). Advantages being that the implant are not loaded, the patient has the convenience of a fixed prosthesis, and no tooth structure is removed from the abutment tooth.

2. USE OF PROVISIONAL-FIXED PARTIAL DENTURES

In situations where the adjacent teeth have full-coverage restorations that require replacement, provisional fixed partial dentures provide a convenient and predictable option without compromising the implant site. Periodontally compromised teeth can also be retained to support a provisional prosthesis during the healing phase, these teeth eventually being extracted and the restoration becoming fully implant-supported. One advantage of a fixed provisional is that no pressure is exerted on the implant or grafted site. These types of provisionals are generally easy to remove and make alterations. Disadvantages of these types of provisionals include fracture, loosening, and the possibility of recurrent caries.

In the esthetic zone a fixed transitional prosthesis also provides benefits. The patient in **FIGURES 3 AND 4** presented requesting replacement of her removable partial denture replacing teeth Nos. 7 and 9 with implant restorations. On clinical and radiographic examination, there was inadequate buccolingual width for placement of implants in ideal positions. Diagnostic wax pat-

terns were completed (**FIGURE 5**) and a provisional fixed partial denture fabricated for teeth Nos. 7-10 (**FIGURE 6**).

Autogenous bone grafts were completed to augment bone width (**FIGURES 7-9**). The provisional restoration served to maintain esthetics and relieve the surgical site from any untoward pressure in the healing phase. The definitive implant restorations are illustrated in **FIGURE 10**.

3. USE OF STRATEGIC ABUTMENTS

Complex reconstructions that require implants for support take time to complete; this length of treatment is exacerbated when bone grafts are required. Maintaining some natural tooth abutments for this period of time to retain a fixed provisional restoration is one of the best methods to maintain function and esthetics whilst the graft and implant sites are healing. The advantages of a fixed prosthesis are similar to those described earlier for the adhesive type fixed partial denture. Abutments with a poor prognosis are often utilized as these abutments eventually will be extracted when the implants have integrated; these abutment teeth only need to survive until implants integrate.

Strategic abutments are commonly used in complete arch situations when the patient's existing dentition is failing due to periodontal disease. Implant sites are selected first, those teeth occupying the implant sites are removed, and the remaining teeth are used to support a provisional restoration. The alternative to this would be to edentulate the patient

and place an immediate denture. The psychological and physiological changes associated with a complete denture can be dramatic. If onlay grafting is required for these types of patients, the pressure exerted by the removable prosthesis can accelerate resorption of the graft and negate the surgeon's initial efforts. Maintaining a few teeth to retain a fixed transitional prosthesis provides both physiological and psychological advantages for the patient, one of the most important being the psychological security of a fixed prosthesis in social settings (**FIGURES 11-24**).

When integration of the implants is confirmed, the strategic abutments are extracted and the reconstruction with implants as the source of support can continue. Advantages of this approach include maintaining the patient in a fixed prosthesis and protecting surgical and implant sites during the healing phase. Disadvantages include increased cost for the patient and the possible adverse sequelae to implant integration should retained abutments become infected during the integration.

The patient in **FIGURE 11** had a peri-



FIGURE 11. Facial view illustrating periodontally failing dentition. The patient has been treatment planned for complete-arch extractions and fabrication of implant-supported prostheses. The patient wants to avoid a removable prosthesis during the transitional phase.



FIGURE 12. Maxillary occlusal view illustrating classic splinted perio-pros type of prosthesis with precision attachments.



FIGURE 13. Mandibular occlusal view illustrating classic splinted perio-pros type of prosthesis with precision attachments.



FIGURE 14. Panoramic radiograph illustrating bone loss around abutment teeth.



FIGURE 15. Maxillary provisional shell prosthesis prepared in advance to be relined on the day of extraction.



FIGURE 16. Mandibular provisional shell prosthesis to be relined on the day of extraction.



FIGURE 17. Maxillary fixed partial denture removed to evaluate quality of abutment teeth.



FIGURE 18. Strategic abutment teeth maintained to support a provisional fixed partial denture.



FIGURE 19. Mandibular fixed partial denture removed to evaluate quality of abutment teeth.

odontally failing dentition and was treatment planned for removal of all teeth and an implant-supported reconstruction. The thought of a complete denture was unbearable and the opportunity to transition to the implant-supported option without the use of a complete denture significantly softened the blow and enhanced her acceptance of the treatment (**FIGURES 12-24**). The extractions were done in two phases, the maxillary prosthesis was dismantled and the teeth were prepared to receive a fixed transitional

prosthesis in each arch. This prosthesis was placed on the day of extraction. The mandibular prosthesis was then addressed in a similar manner. A bilateral balanced occlusion was provided.⁸ This allowed the patient to function with a fixed prosthesis during the healing phase and allowed the clinician to protect the implant surgical site during the submerged healing phase.

4. TRANSITIONAL IMPLANTS

Immediate loading concepts have been well established. These tech-

niques have been well-documented for implant retained mandibular overdentures and for mandibular implant-supported complete dentures.⁹⁻¹⁴

Prior to the advent of immediate loading concepts, transitional implants were developed to enable undisturbed healing and the patient demand for uninterrupted immediate function and esthetics. The primary function of transitional implants is to absorb masticatory stress during the healing phase, ensuring stress-free maturation of the



FIGURE 20. Strategic abutment teeth maintained to support a provisional fixed partial denture.



FIGURE 21. Smile view of full-arch provisional prostheses in situ.



FIGURE 22. Facial view of full-arch provisional prostheses in situ.



FIGURE 23. Right lateral view of provisional prostheses.



FIGURE 24. Left lateral view of provisional prostheses.

bone around the submerged implants, allowing them to heal uneventfully.^{15,16} Most importantly, patients immediately experience the benefits of implant dentistry and emerge from of the surgical phase with a fixed prosthesis.

The scope of transitional implants can be expanded into diverse applications, such as undisturbed healing of bone grafts and provisionalization of fully and partially edentulous patients. They are particularly useful in situations when bone quality is not adequate for immediate loading of the definitive implants but the patient requests a fixed transitional prosthesis. For a complete arch prosthesis, a sufficient number of transitional implants should be placed to allow survival of the prosthesis should one or two implants fail.

Transitional implants are an effective way to generate esthetic transitional prosthesis. For the clinician they allow evaluation of esthetic, phonetics, and function in the interim phase. Patients can return to their daily activities with a fixed restoration and avoid social embarrassment.

With all the advantages of transitional implants they still should be used with

caution. On occasion, the volume of bone used for their placement may be of strategic value during treatment and risks being destroyed by fibrous tissue formation or bone resorption when loaded immediately. Also, if a definitive implant fails, the alternate site has already been used and is unavailable.

5. IMMEDIATE LOADING

The predictability of dental implants using the traditional Branemark protocol has been well-documented. Since its inception, this protocol has been progressively challenged to decrease treatment time, minimize the number of surgical procedures, and maximize esthetic outcomes.

Practitioners should be aware that the Branemark protocol was empirical and based on clinical observation, it was a protocol that ensured integration of implants, but each and every step may not be necessary.¹⁸ Treatment of completely edentulous patients with dental implants highlighted many complications during the osseointegration phase. Complications involving complete dentures worn during the

period of osseointegration included loose dentures, fractured prostheses, sore spots, and periodic provisional relines. Today, in specific clinical situations, implants may be placed and immediately loaded with provisional restorations. Immediate loading in the edentulous mandible has been well-documented.¹²⁻¹⁴ There are also patient treatment reports to show that immediate loading of the edentulous maxilla is feasible if bone quality is suitable.^{19,20}

Immediate loading is a very effective way of transitioning patients from teeth to a complete full arch implant-supported restoration. Based on guidelines from previous studies primary stability appears to be the most important parameter for immediate loading.¹²⁻¹⁴ Stability is dependent on proper surgical technique and type of bone.

The following recommendations should be considered to maximize success:²¹

1. The bone quality and quantity should be adequate. A minimum bone height of 10 mm is desirable and adequate bone quality (type I or II) are ideally required.
2. Implants should be at least 10 mm long.
3. There should be an adequate number and distribution of implants to provide cross arch stabilization.
4. Good initial stability of the implant with minimum insertion torques of 35-50 Ncm²²
5. Passive fit of the provisional restoration
6. Sufficient interocclusal space should be present to allow fabrication of a



FIGURE 25. Preoperative situation illustrating overerupted mandibular anterior teeth.



FIGURE 26. Occlusal view of palate showing trauma to palate from existing denture.



FIGURE 27. Occlusal view illustrating mandibular tori.



FIGURE 28. Surgical guide.



FIGURE 29. Implant placement using surgical guide. Sufficient space must exist between the incisal edge and the head of the implant to allow for bulk of restorative material.



FIGURE 30. Implants placed note favorable anteroposterior spread.

provisional restoration with adequate rigidity.

7. Even occlusal contacts
8. Cantilevers should be avoided or minimized to one premolar (**FIGURES 32 AND 33**).

9. Removal of the provisional restoration should be avoided during the osseointegration period.¹⁴

10. Patients with parafunctional habits may not be ideal candidates.

Advantages of immediate loading are obvious for the practitioner. The practitioner benefits from a reduced number of postoperative visits and reduced maintenance of the provisional restoration⁴ (**FIGURES 25-35**).

Risks of immediate loading are perceived to be higher during the first week following the insertion of implants. The bone interface is actually stronger on the day of implant placement compared with the time three months later, although this is location-dependent.²³ The risk of immediate loading is implant failure and implant failure can cause the use of a removable prosthesis if the remaining

distribution of implants will not allow proper stabilization of the provisional restoration, an unstable restoration would jeopardize the remaining implants. Failure also brings with it additional appointments and greater chairtime for the clinician, which translates to increased costs. Patients must be made aware of the risks of failure prior to embarking upon this path; immediate loading is a risk both patient and clinician must share.

One benefit of immediate loading is function, and, of late, the benefit to esthetics has come to the forefront. Clinicians have recognized that preserving the hard and soft tissue components that exist around natural teeth while transitioning to implants is easier and more predictable than losing these elements following tooth extraction then trying to rebuild them. Techniques that involve immediate extraction, immediate placement, and immediate loading have also been advocated.

The advantages of immediate restoration are obvious; however, the application of immediate or early load may pose an increased risk of implant failure

in single-tooth situations. The parameters for achieving and maintaining equal success rates of osseointegration for single teeth are not fully known.

Sufficient data are available to support the concept that immediately restored and loaded implants in single-tooth situations in the esthetic zone can achieve integration using many implant systems and protocols.²⁴⁻²⁶ Many authors have concluded that esthetic results in immediately loaded sites are superior to that achieved with a staged approach because of gingival architecture preservation.

Most studies and patient treatment reports are carried out by highly trained clinicians working under strict protocols. These protocols respect certain parameters. Factors that have been highlighted to improve the success rate include absence of parafunctional habits, use of a roughened implant surface, use of a threaded implant, and, most importantly, primary stability. Removing occlusal contacts and enforcing a soft diet have also been proposed.

The risk of immediate load in a single-



FIGURE 31. Provisional cylinders have been attached to transmucosal abutments.



FIGURE 32. Provisional cylinders have been attached to relieved denture intraorally (using GC resin, GC America).



FIGURE 33. The remaining space between the provisional cylinders and the denture is filled with pink acrylic resin.



FIGURE 34. Cantilevers are removed from the prosthesis and the prosthesis is polished.



FIGURE 35. Smile view of screw retained immediate load prosthesis. Prosthesis has been adjusted to allow the patient to maintain hygiene.

tooth situation should be obvious to the clinician. The risk of failure is a costly one that has both biological and financial repercussions. Many studies and reports do not address the consequences of failure and how the patient is managed.

It is prudent to ask:

- Is immediate loading in the esthetic zone really worth the risk?
- Does delaying placement of the restoration disadvantage the patient?

Immediate loading in the esthetic zone is becoming ever more accepted. The clinician has a chance of success with adequate treatment planning, incorporating as much clinical data as possible and understanding the limitations imposed. Patient selection and risk/benefit analysis for each patient will lead to more predictable and desirable outcomes.

Summary

An axiom of traditional prosthodontics is to provide a fixed prosthesis whenever possible. When patients are going through lengthy and costly implant therapy their expectations for both func-

tion and esthetics are high. This expectation stands for both the provisional and definitive restoration. Patients prefer to avoid wearing removable restorations in the transitional phase. The advantages of this have been previously outlined. There are many options to transition a patient from tooth-supported to implant-supported restorations utilizing a fixed transitional prosthesis.

The increased costs are offset by the practical and psychological convenience of a fixed prosthesis. Patients realize the benefits of implant therapy immediately and are more likely to be accepting of treatment plans involving extensive implant restorations. ■■■■

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TO REQUEST A PRINTED COPY OF THIS ARTICLE, PLEASE

CONTACT Sajid Jivraj, DDS, MSED, 300 Esplanade Drive, Suite 1600, Oxnard, Calif, 93036.



The Team Approach: Simplifying Complex Care

DAVID HOCHWALD, DDS; SIMONA ARCAN, DMD, MD; AND FARIBORZ FARNAD, DDS

ABSTRACT In today's oral and maxillofacial surgery practice, the interaction between the oral and maxillofacial surgeon, the restorative dentist, and the rest of the dental and medical community is the foundation of daily patient care and management. The combination of the talents from each medical and dental discipline results in the highest quality of patient care. The following will illustrate the power of the comprehensive team approach.

AUTHORS

David Hochwald, DDS, is a board-certified oral and maxillofacial surgeon in Bellflower and Huntington Beach, Calif. He is a clinical professor at the University of Southern California, School of Dentistry, and director of the Surgical Implant Program.

Simona Arcan, DMD, MD, is a board-certified oral and maxillofacial surgeon in Bellflower and Huntington Beach, Calif. She also is a member of the Long Beach Memorial Medical Center's cleft palate team.

Fariborz Farnad, DMD, is an oral and maxillofacial surgeon in Bellflower and Huntington Beach, Calif. He also is a faculty member of the University of Southern California, School of Dentistry.

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Oral and maxillofacial surgery has always been an exciting, discipline and specialty of dentistry. The scope of treatment and expertise of the specialty continues to evolve and improve. Today's materials and techniques allow us to routinely provide care on a daily basis that could only be dreamed about in the past. This high level of care continues to advance as we push toward the future.

The interaction between the oral and maxillofacial surgeon, the restorative dentist, and the rest of the dental and medical community is the foundation of today's daily patient care and management. Dentists must strive to improve this interaction as the outcome of treatment is based on how well we all work and communicate with each other. Combining the talents of more than one medical and dental discipline is indicated and necessary in a large number of patient treatment plans and re-

sults in the highest quality of patient care.

The best diagnosis and treatment for the patient occurs when dentists are aware of the services each discipline is capable of providing and their own limitations. This article will illustrate treatment planning and care highlighting a few of today's common oral and maxillofacial surgery services as examples.

Dentoalveolar procedures including extractions and alveolectomy, excision of pathologic lesions, treatment of trauma, and reconstruction have historically been the foundation of an oral and maxillofacial surgeon's daily patient care. The specialty's unique training also provides oral surgeons with the ability to safely administer outpatient general anesthesia and IV sedation, along with local anesthesia, and makes it possible to provide daily office procedures virtually pain-free.

The introduction of osseointegration, the first highly predictable long-term

dental implant technique, to the United States in the early 1980s had a very positive effect on the authors' daily oral and maxillofacial surgery practices as it has on all of dentistry by greatly improving the level of care and its benefits to patients' lives.¹ The authors, as do many oral and maxillofacial surgery practices, now provide bone preservation procedures at the time of extractions, alveolar bone grafting, sinus floor bone grafting, and soft tissue procedures in their offices or hospital and/or outpatient surgery centers when necessary to make the placement of dental implants possible and predictable for oral and maxillofacial reconstruction.

Since the profession's diagnosis, treatment planning, and surgical procedures are now geared toward the ultimate placement of dental implants for long-term definitive treatment, it means treatment planning and communication between the providers of patient care is of the utmost importance from the outset.

The treatment process generally begins in the restorative dentist's office where the patient presents with one or more specific or general concerns. This most often makes the restorative dentist the first contact point for the patient's treatment and the gateway to the other members of the treatment team. After listening and noting the patients concerns, the restorative dentist performs a thorough examination of the patient and derives a problem list. The clinical examination includes the dentition, periodontium, skeletal and bite relationships, along with a general facial and esthetic evaluation²⁻⁴ (TABLE 1).

A radiographic examination is also indicated and should include, at the minimum, oral X-rays by the restorative dentist. Often a panoramic radiograph is indicated, and, depend-

ing on the list of patient concerns and problems, cephalometric radiographs and/or CT scans are necessary.

Diagnostic casts are very helpful. Photographs are also helpful for information sharing between providers and are an excellent way to document pretreatment conditions. They are also helpful for patient presentation and education. The appropriate member of the treatment team orders the proper radiographic and other indicated studies. Their findings are then shared with the other team members to plan definitive treatment.

The following patient treatment case illustrates the interaction between members of the treatment team and show some of the ways the oral and maxillofacial surgeon can provide support for comprehensive patient treatment and add to the scope of care provided to patients in the restorative dental office (FIGURES 1A-C AND 2A-B).

This 26-year-old male presented for treatment to the restorative dentist's office with complaints of not liking the esthetics of his anterior bridgework, his inability to occlude his teeth together, poor speech, difficulty eating, and muscle pain with function. He was highly conscious of his problem and felt it was a major issue in his personal and professional life. He also was a very apprehensive patient who had difficulty sitting through routine dental procedures.

Problem list

- Maxillary posterior vertical hyperplasia (FIGURES 1A-C AND 2A-B)
- Apertognathia (FIGURES 1A-C AND 2A-B)
- Lip incompetence (FIGURES 1A-B AND 2B)
- Mentalis habit (FIGURE 1B)
- Tongue thrust habit (FIGURE 1A)
- Partial edentulism anterior maxilla and mandible (FIGURES 1B-C AND 2A-B)
- Alveolar vertical and horizontal

TABLE 1

Examination Checklist

Dentition

Caries
Crowding
Alignment
Unerupted and impacted teeth
Retained deciduous teeth
Edentulous areas
Bite relationships
Occlusal planes
Esthetics

Periodontium

Bone levels
Soft tissue-health attached muscle attachments
Esthetics

Skeletal

Maxillary horizontal anterior-posterior excess and deficiency
Maxillary vertical excess and deficiency
Maxillary lateral width excess and deficiency
Apertognathia (open bite)
Mandibular anterior-posterior excess and deficiency
Mandibular pogonion and menton vertical and horizontal excess and deficiency
Asymmetry
Esthetics

Facial Esthetics: Bone and Soft Tissue

Lips — length-symmetry-fullness
Nose
Eyes
Ears
Cheeks
Skin
Neckline



FIGURE 1A. Photo illustrates lip incompetence, apertognathia, and poor tongue position. It also shows that the display of the maxillary central and lateral incisal edges below the upper lip at rest are within normal limits (2 mm).



FIGURE 1B. Pretreatment lateral cephalometric X-ray shows maxillary posterior vertical hyperplasia, apertognathia, lip incompetence, mentalis habit, and alveolar horizontal width deficiency in the maxillary and mandibular anterior.



FIGURE 1C. Pretreatment panoramic radiograph indicates partial edentulism in the anterior maxilla and mandible, apertognathia, and the general condition of the teeth and associated structures.

deficiency anterior maxilla and mandible (**FIGURES 1B, 5, 9, AND 10**)

History

- Previous orthodontic treatment for approximately three years. Completed at age 13
- Attacked at age 16, resulting in loss of maxillary and mandibular anterior teeth, and alveolar bone loss
- Removable prosthesis worn until fixed partial dentures were placed in the anterior maxilla and mandible at age 19
- Development of a significant anterior open bite during completion of growth

Treatment Sequence

- Restorative dentist exam and referral to oral and maxillofacial surgeon, orthodontist, and periodontist
- Examinations by oral and maxillofacial surgeon, orthodontist, and periodontist
- Communication between all team members
- Development of a comprehensive treatment plan
- Presentation of the treatment plan to the patient with costs
- Acceptance of treatment plan by patient
- Treatment

Treatment

1. Assessment of dentition and occlusion by restorative dentist with decision among team members to use



FIGURE 2A. Pretreatment photo indicates the general condition of the existing dentition, soft tissues, and occlusion.



FIGURE 2B. Preoperative lateral cephalometric radiograph taken after initial orthodontic treatment. Used to plan orthognathic surgery procedures.



FIGURE 3A. Postorthognathic surgery photo of dentition and occlusion showing correction of apertognathia.

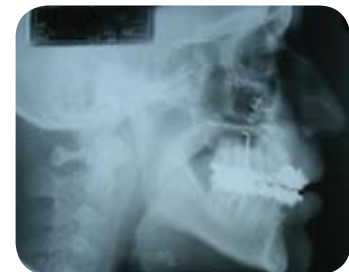


FIGURE 3B. Postorthognathic surgery lateral cephalometric X-ray. Shows correction of maxillary posterior vertical hyperplasia, apertognathia, lip incompetence, and mentalis habit. Notice plate and screw fixation in superior maxilla used for the procedure.

existing anterior maxillary and mandibular fixed partial denture restorations until after orthodontics and orthognathic surgery (**FIGURES 1A-C AND 2A**)

2. Periodontal evaluation to determine bone and soft tissue health around the teeth for orthodontics, orthognathic surgery, and later bone graft and implant reconstruction

3. Orthodontic treatment to setup maxillary and mandibular dentition for orthognathic surgery-periodontal maintenance (**FIGURE 2B**)

4. Orthognathic surgery by oral and maxillofacial surgeon⁵

Le Fort 1 maxillary osteotomy to intrude posterior maxilla and close anterior open bite (**FIGURES 3A-B AND 4A**)



FIGURE 4A. Photograph of anterior occlusal relationship just prior to removal of orthodontic appliances following orthognathic surgery and postsurgical orthodontics. Notice the normal vertical overlap (overbite) and horizontal overlap (overjet).



FIGURE 4B. Panoramic radiograph made prior to bone grafting. Notice the original maxillary and mandibular fixed partial dentures have been replaced with new provisional restorations to facilitate prosthetic management through the grafting and implant treatment phases.



FIGURE 5. Photograph during bone graft surgery showing the vertical and horizontal deficiency of the anterior maxilla in relation to ideal tooth position indicated with the prefabricated maxillary surgical guide indexed on the posterior maxillary teeth.



FIGURE 6. Photograph during surgery of the cortico-cancellous blocks harvested from the iliac crest fixed into position to reconstruct the anterior maxillary alveolar deficiency. Cortico-cancellous particulate bone from the ilium was packed around the blocks to address the vertical component of the deficiency. The bone graft was covered with a pericardium membrane before tension-free closure of the soft tissue was accomplished.^{9,10}



FIGURE 7. Photograph taken immediately after bone graft surgery with surgical guide in place for reference. Anterior-posterior view to confirm vertical and horizontal correction in area.



FIGURE 8. Photograph taken immediately after bone graft surgery with surgical guide in place for reference. Occlusal view to confirm vertical and horizontal correction in area.

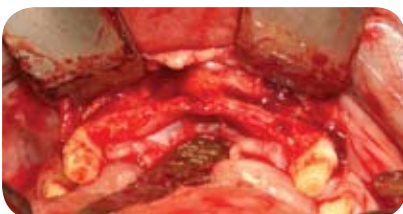


FIGURE 9. Photograph during bone graft surgery showing horizontal alveolar defect in the anterior mandible.



FIGURE 10. Photograph during bone graft surgery with surgical guide in place to illustrate the extent of the anterior mandibular alveolar deficiency requiring bone grafting.

5. Completion of orthodontics after initial healing of orthognathic surgery (**FIGURES 3A-B AND 4A**)

6. Removal of the original maxillary and mandibular anterior fixed partial dentures with fabrication of new maxillary and mandibular fixed provisional restorations by the restorative dentist in preparation for bone grafting and implant treatment (**FIGURE 4B**)

7. Fabrication of maxillary and mandibular surgical guides (duplication of the new provisionals) by the restorative dentist to be used by oral and maxillofacial surgeon for bone grafting and implant placement (**FIGURES 5-8, 10 AND 12**)

8. Bone graft to reconstruct the alveolar vertical and horizontal deficiencies in the

anterior maxilla and mandible by the oral and maxillofacial surgeon using bone harvested from the left iliac crest in block and particulate fashion^{6,7} (**FIGURES 6, 11 AND 13**)

9. Management of patient's provisional restorations during graft healing by the restorative dentist (approximately four to six months) (**FIGURE 13**)

10. Implant placement was done by the oral and maxillofacial surgeon using previously fabricated surgical guides with immediate indexing of implant positions at surgery to make fabrication of fixed implant-supported provisional restorations during implant healing pos-

sible.⁸ Healing abutments were connected for single surgery approach and to help manage soft tissue (**FIGURE 15**)

11. Adjustment and replacement of the anterior maxillary and mandibular provisional restorations were done by the restorative dentist after surgery to remain in place until implants were healed (four months) (**FIGURE 15**)

12. Placement of the fixed implant-supported provisionals that were made during implant healing by the restor-



FIGURE 11. Photograph during bone graft surgery showing cortico-cancellous block grafts to both the labial and lingual of the anterior mandible. Use of the surgical guide for reference during surgery indicated this approach was necessary. Particulate cortico-cancellous bone from the ilium was packed around the blocks and the entire graft was covered with a pericardium membrane before tension-free closure of the soft tissue.



FIGURE 12. Photograph taken immediately after bone graft surgery with surgical guide in place for reference. Confirms vertical and horizontal correction in the area.



FIGURE 13. Panoramic radiograph made immediately following bone graft surgery with adjusted maxillary and mandibular provisional restorations in place. Bone graft fixation screws evident in the maxillary and mandibular anterior areas.



FIGURE 14A. Occlusal photograph of the maxillary anterior area with the provisional restoration removed to show the result after bone graft healing prior to implant placement.



FIGURE 14B. Photograph of the mandibular anterior with the provisional restoration removed to show the result after bone graft healing prior to implant placement.



FIGURE 14C. Photograph of the anterior maxillary and mandibular edentulous areas after bone graft healing with the provisional restorations removed. Notice the relapse of the vertical correction, which occurred during healing, particularly in the maxillary anterior.



FIGURE 15. Postoperative panoramic radiograph made immediately following implant placement to the maxillary and mandibular anterior edentulous areas. Provisional restorations were adjusted and repositioned immediately after surgery by the restorative dentist.



FIGURE 16. Photograph of the maxillary and mandibular provisional restorations modified as indicated following implant placement. Notice the added gingival material to cover the remaining vertical soft tissue defects in the maxillary anterior.



FIGURE 17. Photograph of the final anterior mandibular implant supported fixed restoration. The patient is very happy with the functional and esthetic result. The photo also shows the need for soft tissue surgery around tooth No. 21 to create healthy fixed esthetic mucosa.

ative dentist and lab to manage soft tissue and initial esthetics (**FIGURE 16**)

13. Adjustment of the provisional restoration by the restorative dentist to meet the esthetic desires of the patient as well as to ensure proper function (**FIGURE 16**)

14. Final implant restorations by the restorative dentist for the anterior maxilla and mandible (**FIGURES 17 AND 18**)

15. Periodontal plastic soft tissue procedures by the periodontist for tissue coverage to mucogingival defects present on the mandibular premolar teeth

(original abutment teeth) (**FIGURE 17**)

16. Final restorations for the mandibular premolar teeth by the restorative dentist to complete treatment

17. Long-term maintenance by the restorative dentist with help from other disciplines as needed



FIGURE 18. Photograph of the final anterior maxillary and mandibular fixed, implant-supported restorations. Notice the pink porcelain abutting the maxillary gingival tissue. It is designed to provide optimum esthetics by hiding the remaining soft tissue deficiencies in the maxillary anterior. It is also helpful during function to block air escape that can occur during speech. It is important to design it to provide good access to the patient for hygiene.

Conclusion

Choosing the right team and working closely together results in the highest quality of treatment for the patient, expands the range of care we can offer, and makes the practice of dentistry more fun and rewarding for all involved. ■■■■

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CONTACT David A. Hochwald, DDS, 14343 Bellflower Blvd., Bellflower, Calif., 90706.

Gold Fever



The saddest-looking old bridge or crown is offered to, and immediately accepted by, patients who believe they've got the makings of a Mercedes down payment.

→ Robert E.
Horseman,
DDS

ILLUSTRATION
BY CHARLIE O.
HAYWARD

To increase the value of gold, have it handled by a dentist.

— Anonymous

Gold is currently enjoying a world-wide bull market with the price hovering around \$1,000 an ounce. This phenomenon that places gold right up there with the per-ounce cost of women's antiaging petroleum-based cosmetics and the Olsen Twins' Halloween eye enhancements, is causing some concern in the dental profession.

Patient: All this gold you placed in my mouth 30 years ago? I want it replaced with that white stuff. Just put the gold in this little strong box here.

Dentist: No! Not a chance, forget it! Unh-uh. How about I replace it with white gold?

Patient: Nope, white gold is like white chocolate — it's not real! Upon my demise, I am requesting cremation. Who gets the gold then, huh?

Dentist: I've often wondered, but have been afraid to ask. Never see ads of

cremation societies offering attractive urns for your noncombustibles including whatever nuggets of precious metals that might show up, do you?

With interest in cashing in on the auriferous bull market at fever pitch and dental gold having no sentimental value compared to grandma's wedding ring, dentists experience very little salvaging themselves.

"I could never part with my gold crown. I just love the angulation of the buccal cusps, the fine detail of the occlusal anatomy and the undetectable margins. It and I have been through too many gourmet meals together. I'm having it made into a nose ring." Heart-warming, but unheard of. Instead, the smallest inlay, the saddest-looking old bridge or crown is offered to, and immediately accepted by, patients who believe they've got the makings of a Mercedes down payment transferred from their mouths to the little Ziploc bag in their hands.

CONTINUES ON 637

DR. BOB, CONTINUED FROM 638

Pawn shops are doing a gold rush business. Small knots of people willing to undergo a soft diet indefinitely, gather outside debating on how to divest themselves of their gold mines painlessly before the inevitable bear market returns. Members of gold restoration study clubs gear up with protest signs prepared to picket the insanity of such shenanigans.

The dental profession is not caught napping. The plan is to offer those patients who value the properties of gold as a restorative material a measure of protection. People are understandably paranoid walking about at night in dimly lit places where gold muggers are likely to lurk. Taking a leaf from General Motors that offers LoJack protection in most of its cars, dental suppliers are feverously working to provide patients with a dental equivalent.

It is supposed to work like this: Inserted into the matrix of all gold restorations from now on will be a small chip made of whatever small chips are usually made of, only smaller. You suddenly awaken at 3 a.m., the time nowadays when bad things are apparently scheduled. Heart pounding, stomach churning as if in response to bad clam dip, you discover a dark figure armed with a pair of Ford pliers and a small ball-peen hammer standing at the foot of the bed.

"Open wide!" Darth Vader demands, pretending to be a dentist with an authoritative chairside manner. Two things happen immediately — three, counting sphincter malfunction. The motion sensor in the gold, activated by the bad person's demand and your own 180-decibel reaction, sends a message to LoJack whose

response mechanism will be conveniently outsourced in Bombay.

The company in turn, assuming you've paid your monthly subscription fee, alerts your local police department where a dispatcher familiar with Indian patois stands by. Should the perp make good his liberation of your gold, the intelligent chip obliges, transmitting a location finder that will appear automatically on all global positioning devices within 5,000 miles.

Your crown/onlay should be returned to you within 24 hours, ready for recementation unless you elect to join the queue at the pawn shop, realizing that some possessions are not really worth the hassle. In which case, we can offer a nice selection of porcelain or resin replacements in 26 shades of white with no salvageable value whatsoever. ■■■■