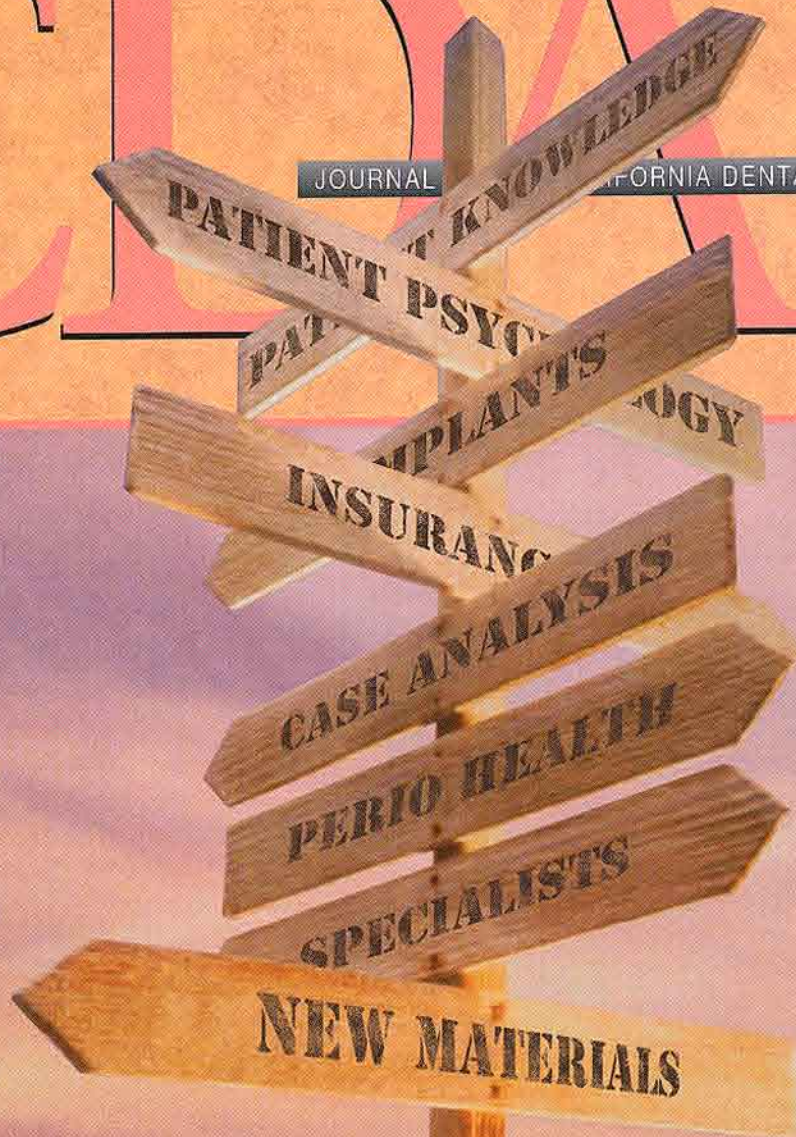


Cosmetic Dentistry  
Anterior Implants  
Thick vs. Thin  
Gingiva

JOURNAL

CALIFORNIA DENTAL ASSOCIATION VOL. 30 NO. 7

July 2002



# Treatment Planning

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## Wanted: An Improved Public Message

JACK F. CONLEY, DDS

**D**uring the last decade of the 20th century, dentistry often was cited in the upper tier of image polls conducted by groups such as the Gallup Organization. Dentistry fairly regularly was listed in the top 10, and often in the top five, of the “most trusted professions.”

We have not seen the results of such a poll recently, but wonder if the profession would still find it self in the lofty positions described if a new poll was taken today. We do have concern that activities both inside and outside of the profession have been damaging the image that the profession enjoyed a few years back.

It may be that dentistry's image has not suffered any more than that of other occupations and professions in this era of increased public scrutiny. The presence of the media during times of legislative, regulatory, or even legal scrutiny can raise the public's awareness of the slightest misstep or question centering on an individual or the profession. However, with mid-year 2002 upon us, we believe that dentistry could benefit from an improved message to the public over the one that has been building over the past year. A continuation of some of the bad press that the profession has been experiencing of late dulls the positive image that is so important to a health care professional. Let's examine our concern, reviewing a few of the danger signals in no particular order.

The organized profession has been extremely careful to avoid word and

action that suggests self-interest on behalf of the profession. Service to the public has always been placed in front of any language or activity that suggests that it is self-serving to the interest of dentists. The lawsuits against CDA and ADA in the past 18 months, while not directly suggesting dentistry's conduct is self-serving, nonetheless convey that spirit to the public. For example, language in lawsuits filed against the associations in regard to alleged amalgam toxicity accuse dentistry of fraud, apparently because of the profession's long-standing defense of the safety of amalgam. There is an implication that dentistry's defense of amalgam has been based upon economic self-interest, with the consequences of harm to the health of the public. These “public charges” in legal actions against the profession, while lacking science to support the claims, leave an unsuspecting public (and the media) to assume that, yes, the profession is defending the continued use of the material for economic gain.

While many members of the dental profession will recognize the “deep pockets” legal strategy being employed by the plaintiff legal counsel, we suspect the average member of the public may more readily be influenced by the emotional charge of “fraud” against dentistry. However, these legal assaults perpetrated from outside the profession are not the circumstances that concern us the most. They may be lengthy and costly; but, ultimately, science will be an important

ally of the profession in the resolution of these challenges. The publicity generated contributes to the severity of the negativism of the messages being conveyed about the profession these days.

While the profession faces these legal accusations, there continue to be suspicions within the profession that some dentists who actively promote replacement of amalgam restorations do so for economic, rather than for the health-based or patient-requested cosmetic reasons often advanced as the rationale by these practitioners. On the global issue of amalgam, any way we analyze it, the profession faces an image problem based upon the notion sold to the public that economics too often is a more important consideration than the oral health care needs of the patient.

Despite the high level of notoriety surrounding the amalgam/mercury issue, the most serious messages leveled against dentists may be those seen in the print media aimed at what we shall refer to as the treatment-planning practices of some individuals in our profession. Recent media stories remind us of the article carried in *Reader's Digest* in February 1997 that created quite a stir inside and outside the profession. These reports always have one thing in common: stories of unhappy patients who were offered expensive treatment plans that seemed to lack standardization of treatment philosophy from office to office. They conclude that many dentists present treatment plans that recommend excessive and unnecessary replacement of crowns and other restorations, overly promote cosmetic dentistry, and lack guidelines for their decisions, scientific or otherwise, that patients can understand.

There appear to be two results of these public airings. First, the question as to the honesty of many of our colleagues

is raised. Second, many of the media investigators have knowledge that the incidence of caries has been on the decline and that we are in a period where there are fewer new dentists graduating and engaging in practice. Therefore, they conclude that practitioners can more readily mask their economic self-interests in establishing fees and treatment-plan philosophy during a period of high demand for their services.

Journalist Chris Pummer recently circulated a particularly damaging report to the image of dentistry on CBS.MarketWatch.com. His report was titled, "A Profession in Decay -- Dentists' Business Practices Increasingly Suspect." He bases much of his report and his conclusions on personal experiences he had in interacting with members of the dental community. We will not attempt to evaluate or analyze his findings or his conclusions beyond stating that if his experiences are valid as presented, they portray a very negative image of dentistry. His remarks about dentists are at times scathing and will make ethical practitioners cringe at his characterizations of our profession and some of our colleagues.

The real wake-up call for our profession is best articulated by a few passages from his article. First, the author indicates that a consumer trying to determine if they've found a good dentist faces the complication that dentistry "lacks recognized standards of care." While we know that professional standards of care exist, Pummer passionately believes that standards do not exist. Or, he could be conveying a message that he and the consumer population have not been properly educated as to what they might be. He continues: "In other words, one dentist may suggest treating tooth decay

with a new less-invasive technique called remineralization, another might recommend a deep filling, a third might suggest a crown and a fourth might say supportive bridgework also is in order -- and all four would have defensible positions in the eyes of the profession."

In making the latter statement, he does demonstrate that he possesses a decent level of education about the possible options for treatment -- a level of education that will probably help him convince other dental consumers that he just might be a well-informed critic about the dental profession.

Considered together, these concerns suggest to this observer that the profession, and particularly those of us who practice general dentistry, will need to spend more time in the future on patient education. Patients must be provided a better explanation of their options than many are apparently receiving. Due to the many variables that drive the management of time in the contemporary practice, many patients receive neither the education nor the opportunity to consider their options of treatment. They turn to what has become the accepted source for health care information for many people -- the media. Until the profession can reverse the public's dependence on media-generated information by improving the level of patient education in our offices, the image of the profession will remain at a level that is less than optimal.

If our goal is to achieve an improved public message, improved patient educational efforts in the dental office that validate our commitment to good oral health will serve as the most important ingredient.

## New Soldiers in the Digital Revolution

By DELL RICHARDS

Recent demographic trends are shaping American society in unprecedented ways. With their enormous wealth and education, baby boomers are reinventing the consumer. Thanks to the Internet, nearly half of computer owners research health questions online. When they come to the office, they arrive with knowledge.

Due to these advantages, they have created lifestyles undreamed of by their parents -- lifestyles of luxury goods and designers labels.

Willing to shell out big bucks for lifestyle items, baby boomers can be quite miserly. The Internet allows them to comparison shop. As a result, they often want the cheapest possible price, or, when it comes to health care, as much as possible paid by insurance.

Because they work harder and sleep less, baby boomers are also demanding more value from their time. Businesses are responding by merging with entertainment.

"Goods and services are no longer enough," said James Gilmore, co-author with B. Joseph Pine of *The Experience Economy: Work Is Theater & Every Business a Stage*. "Customers want experiences that engage them."

Gilmore does not mean theater as metaphor; he means literally. "Whether they know it or not, whether they do it well or not, when one person watches another work, that person is acting," Gilmore said. "They must act in a way that engages each guest with every interaction."

While that might seem like an outrage to health care professionals, some dentists already are incorporating entertainment into their practices -- with enormous success.

With offices in Southgate and Norwalk, Scott Jacks, DDS, is proud of the fact that

he entertains his patients, two-thirds of whom are children and teenagers. But the one-third who are adults are treated to movies just like the kids are.

Jacks' patients enter a video arcade with televisions on the floor, big viewing screens and movie-theater-type seating. "I'm just a big kid myself," said Jacks, who has more than 20 dentists in his practice. "I wanted it to be enjoyable for everyone, for adults as well as children. It's definitely made the practice of dentistry more fun for my patients -- as well as myself."

After treatment, patients often stay to finish watching movies in the waiting room.

"We have patients who come in early and don't leave right away."

While Jacks is one of the few general dentists using entertainment in his practice, pediatric dentists have been using interactive ideas for decades.

With offices in Camarillo, Oxnard, and Simi, Mark Lisagor, DDS, deliberately chose to play down his own identity to create a theme that would work for the practice -- and any dentist in it. Begun 25 years ago, his spaceship dental office has chrome "woodwork" and doors that open like those on *Star Trek*. "The automatic doors go 'whoosh' when they open," Lisagor said. "And there is a tunnel to the clinical area."

Lisagor carefully chose a look and theme that would appeal to children of all ages, one that 3-year-olds would enjoy but that wouldn't offend teenagers or their parents. His office also has Nintendo and other games.

While Lisagor admits that the entertainment aspect of his practice has been good for business, he does worry about children expecting to be entertained 24/7. "Parents are taking their kids from one orchestrated activity to another. I'm not sure we're developing self-reliant

adults."

Nonetheless, Lisagor believes that as long as the entertainment promotes good dental habits -- and lessens the fear of the dental experience -- the benefits outweigh the drawbacks.

At the Tustin office of Mike McCartney, DDS, and Warren Brandli, DDS, a robot named Dr. Beap has made as big a name for himself as the dentists by teaching children about brushing and other dental subjects. In fact, children are more apt to pay attention to the television in Dr. Beap's belly than to an adult.

"The kids are mesmerized by the robot," McCartney said. "They will listen to lessons about hygiene and flossing that they never would from the parent or me."

Specially built nearly 15 years ago, Dr. Beap creates a memorable experience for children and adults alike.

For dentists, creating a positive experience is the real challenge. Wayne Grossman, DDS, is on his third theme office. His first focused on nutrition and had a coffee table of soft-sculptured carrots and over-sized apples.

His second had a railroad with large-gauge trains running through the offices and carriage seats in the waiting room. An event display encouraged people to ride trains and visit train museums. People sent train-related postcards that Grossman displayed.

"It gave us something to talk about with the children other than dentistry," Grossman said. "When the grandparents sat in the seats, their eyes would get misty thinking about the past."

Today's Gold River office has a national parks theme with a rustic lodge look, waterfalls, and a trout stream.

"People said the trout stream couldn't be done," Grossman said. Undaunted, Grossman now has two huge tanks of wild fish -- one with trout and one with bass

and blue gill -- as well as a stream. Children can watch the fish from the operatory.

Although educational, bringing the outdoors in is very relaxing. "We're trying to raise the dental I.Q. while creating a generation of people with a better experience."

Dell Richards is the owner of the Sacramento public relations firm Dell Richards Publicity. She specializes in health care clients.

### Dental Benefits Still Valued Part of Employee Compensation Offer

A new nationwide poll shows that despite growing concerns with the nation's health care system, demand for employer-sponsored dental benefits remains high; and most Americans don't generally associate challenges facing today's national health care system with dental benefits.

The survey, conducted by Taylor Nelson/Sofres Intersearch for Delta Dental, addresses several aspects of American attitudes regarding dental benefits. For instance, it suggests that most Americans expect dental benefits to be offered, and they do not view the rising cost of medical insurance to employers as a plausible reason for cutbacks in their employer-sponsored dental programs.

"Health care inflation is challenging benefit consultants and their clients to rethink their overall approach to benefits, and in some cases to shift costs to their employees or even eliminate ancillary benefits like dental or vision," said Gary D. Radine, president and CEO of Delta Dental Plan of California. "The survey, however, indicates that dental benefits are not viewed as dispensable by job seekers, and that reducing or eliminating dental is not likely to be appreciated or understood by the workforce."

Radine said the survey also shows widespread agreement with the idea that dental is different with respect to some of the larger challenges faced by the nation's health care system.

Against a random sample with a margin of error of plus or minus 3 percent,

the survey uncovered the following prevailing attitudes regarding dental benefits across the nation:

- 48.3 percent of respondents from a base of 1,025 felt it is "very important," and 30.3 percent felt it is "somewhat important," to have dental insurance provided by a prospective employer.
- On a separate question, 635 employed adults responded to how they would react if their employer reduced their dental coverage or increased the employees' contribution. Of respondents with employer-provided dental coverage:
  - 40.6 percent felt this would be a significant loss.
  - Only 18.9 percent felt that their employer would have to be forced into such a move in order to reduce expenses, while 37.6 percent either "strongly agreed" or "somewhat agreed" that such a move was probably done "to improve the bottom line."

### Dental Disease Poses Significant Health Problem for Santa Clara County Children

An in-depth oral health needs assessment recently released by the Health Trust details devastating results among certain Santa Clara County school-age children and reveals a high correlation between socioeconomic status and ethnicity and the risk of dental disease.

Low-income Hispanic and Asian children are particularly vulnerable to poor oral health and access to care. Especially troubling is the large number of local children with rampant tooth decay -- defined as seven or more decayed teeth -- and those with an urgent need for dental care -- defined as pain or infection originating in their mouth. The research was funded by a grant from the California Endowment.

This is the first study to identify the true state of oral health in local children. More than 1,600 students in Head Start, kindergarten and third-grade in the Santa Clara County public school system participated in the survey. The results clearly identify dental disease

as a significant problem for children in Santa Clara County, with one-third of the county's children having untreated tooth decay. This equates to more than 43,000 public elementary school children with decayed teeth. Ten percent of the county's children enter kindergarten with dental pain or an abscessed tooth. By the time children are in third grade, 72 percent have a history of decay.

"The results are devastating for certain populations of children and indicative of the magnitude of challenge that remains in Santa Clara County. Much work needs to be done," said David Lees, DDS, director of the Health Trust Dentistry With Heart initiative that targets the dental needs of underserved children.

These are alarming statistics, considering the perceived economic status of Silicon Valley. The study shows that low-income and minority children are more likely to have dental disease. Fifty-one percent of kindergartners eligible for the subsidized or free lunch program enter school with untreated tooth decay and 23 percent of these children already need urgent dental care when they start school. Hispanic children are three times more likely and Asian children twice as likely to have untreated decay when compared to their white non-Hispanic counterparts. One out of every four Hispanic third grade children sits through classes with pain in his or her mouth.

A full copy of the research report, entitled "Oral Health Status of Children in Santa Clara County" is available at [www.healthtrust.org](http://www.healthtrust.org).

### Researchers Find Clinical Depression May Have a Negative Effect On Periodontal Treatment Outcome

Researchers found depressed patients have twice the odds of suboptimal outcomes from periodontal treatment over one year compared to patients without depression, according to a recent study in the *Journal of Periodontology*.

"There are many factors that could impact treatment outcomes in clinically

depressed periodontal patients,” said John Elter, lead author of the study and a dentist and epidemiologist at the University of North Carolina Chapel Hill School of Dentistry. “For example, the patient’s attitude about the treatment process plays a significant role in treatment success. Depressed patients might view a course of periodontal treatment as an overwhelming ordeal, and might be more likely to not comply with all treatment recommendations.”

“In addition, depressed persons are more likely to continue to smoke, which has been linked to poor response to periodontal therapy,” Elter said. “Most importantly, it is possible that their immune system is impaired, which may slow down the body’s reaction to fight off the infection, but more research needs to be conducted to verify this.”

He continued, “Future studies should focus on elucidating a possible mechanism for the negative effect of depression on the immune system and on wound healing.”

### Scientists Seek Partner for Tobacco Dental Vaccine

Scientists who have developed a vaccine against tooth decay from genetically modified tobacco plants are looking to start large-scale clinical trials.

Scientists at Guy’s, King’s and St. Thomas’ Dental Institute in London said that the colorless and tasteless topical vaccine was the first derived from a genetically modified plant to go into human clinical trials.

“We drip it onto the teeth, but it could also be added to toothpaste or chewing gum,” said Dr. Julian Ma, senior lecturer in the Department of Oral Medicine at King’s College.

The researchers have already carried out intermediate phase II trials in collaboration with Californian biotechnology company Planet Biotechnology, Inc.

Ma said a further partnership with a larger company is now needed for phase III trials involving several hundred patients.

### Antiseptic Mouthrinse Effective as Flossing

Data from two six-month clinical trials comparing the effectiveness of rinsing with an antiseptic mouthwash to daily flossing in fighting plaque and gingivitis showed that the antimicrobial action of an antiseptic mouthrinse is “at least as good as” flossing in improving gingival health and plaque reduction, especially in hard-to-reach areas of the mouth.

“These findings support the benefit of adding an antiseptic mouthwash to a daily oral health care routine, especially for those patients who don’t brush and floss properly,” noted Sebastian Ciancio, DDS, distinguished service professor and chair of the Department of Periodontics and Endodontics at the University at Buffalo School of Medicine and Dentistry. “The findings, however, do not mean that flossing should be replaced with rinsing. I recommend that dentists and hygienists talk to their patients about what’s best for their oral health care routine, and devise strategies to target difficult to reach areas that are susceptible to plaque accumulation and gingivitis.”

In both studies, an antiseptic mouthrinse was clinically comparable to flossing in controlling interproximal gingivitis and better for plaque reduction.

Interproximal plaque accumulation was reduced by 37.5 percent and 20.0 percent ( $p < 0.001$ ) respectively, in patients who rinsed twice a day. In comparison, those patients who flossed daily showed a 2.1 percent ( $p = 0.305$ ) and 3.4 percent ( $p = 0.134$ ) reduction in interproximal plaque accumulation. Both the mouthrinse and flossing groups included brushing with regular fluoride-containing toothpaste and were compared with a negative control treatment group that brushed and rinsed with a placebo rinse.

In addition to site-specific plaque reduction, patients who rinsed twice a day with showed a 7.9 percent and 11.1% ( $p < 0.001$ ) reduction in interproximal gingivitis versus an 8.3% ( $p < 0.001$ ) and 4.3 percent ( $p = 0.006$ ) reduction in those who

### Dental Problems Boost Pneumonia Risk in Elderly

Better dental care among the institutionalized elderly could reduce incidences of aspiration pneumonia, according to researchers from the University of Michigan and Veterans Administration.

In a study of the records of 402 patients ages 57 to 98, patients were shown to be at higher risk for aspiration pneumonia if they had dental plaque or certain types of mouth bacteria.

Overall, patients who had a stroke, had chronic obstructive pulmonary disease, or needed help eating were at risk.

“We know, as a result of previous studies, that it’s just an area that tends to be overlooked in nursing homes, because it’s very hard and somewhat distasteful, as far as nurse’s aides are concerned, to clean someone else’s mouth,” said Margaret Terpenning, of the University of Michigan. “So it’s often left to the residents to clean their mouth, and they just ignore it.”

People with dementia or other conditions that impair their mental status, or those who can’t easily move their hands, are especially likely to have dental problems, she said.

The study was supported by a grant from the National Institutes of Health.



flossed daily.

The two, six-month, randomized, evaluator-blinded, controlled, parallel group studies were presented at the International Association of Dental Research annual meeting.

### Honors

Richard C. Burns, DDS, of San Mateo, Calif., received the Edgar D. Coolidge Award from the American Association of Endodontists. The award, the association's most prestigious honor, is given to an individual who has displayed leadership and exemplary dedication to dentistry and endodontics.

Angelle M. Casagrande, DDS, MD, of Antioch, Calif., was appointed assistant program director of the University of the Pacific's Oral and Maxillofacial Surgery Residency Program with the Alameda County Medical Center, Highland Hospital.

The International College of Dentists' 13th district honored Arthur A. Dugoni, DDS, of San Francisco, dean of the University of the Pacific School of Dentistry, with the Award of Excellence in Dentistry during the annual ICD/American College of Dentists spring dinner and awards ceremony April 5.

Paul Glassman, DDS, MA, MBA, of San Francisco, professor and associate dean at the University of the Pacific School of Dentistry, was elected president of Special Care Dentistry on March 21 in Chicago. Glassman will lead this national organization, consisting of more than 1,100 members, that is dedicated to improving the oral health of people with special needs. Its component organizations include the American Association of Hospital Dentists, the Academy of Dentistry for Persons with Disabilities, and the American Society for Geriatric Dentistry.

The Pierre Fauchard Academy, Southern California Section, presented the Honor Award to Richard Kahn, DDS, of Encino, Calif. In making this award, the academy cited Kahn's 37 years of exemplary service to the dental community.

Peter K. Moy, DDS, Calif., of Los Angeles, has been elected a member of the Board of Directors of the Academy of Osseointegration.

Richard K. Rounsaville, DDS, of Torrance, Calif., has been elected secretary of the Academy of Osseointegration's Board of Directors.

Mahmoud Torabinejad, DMD, MSD, PhD, of Loma Linda, Calif., has been elected president-elect of the American Association of Endodontists. He is currently the director of graduate endodontics and a professor of endodontics at Loma Linda University School of Dentistry.



# Treatment Planning

RICHARD T. KAO, DDS, PhD, AND DONALD A. CURTIS, DMD

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**T**reatment planning should be the single most important thing we do as practicing clinicians. Unfortunately, the nature of dental education and clinical practice tends to orient us toward simply recognizing and correcting the damaging effects of dental problems. If we see caries, we are oriented toward thinking about placing a filling. If periodontal disease is present, we think about scaling and root planing, or possibly periodontal surgery. If a patient is partially edentulous, we simply think about filling the space with a prosthesis. This procedure-driven approach tends to de-emphasize the value of diagnosis, treatment planning, or problem solving, and thus stagnates our development as dentists. In this issue, we challenge the readership to considering how recent advances should change the way we diagnose and treatment plan.

Several recent issues of the *Journal of the California Dental Association* have focused on the importance of technological and therapeutic advances. The use of local antimicrobial delivery systems in periodontal case management, the periodontal-systemic health link, and the OralCDx computer-assisted brush biopsy system for screening oral cancer are just a few topics that the Journal has

recently covered, and these are exciting and relatively new advances that will likely affect how we treatment plan. The focus of this issue will be on techniques and approaches, which are also recent, but are more established and time-tested. For example, recent advances in adhesion dentistry, periodontal surgical procedures, and dental implants have drastically increased the options when treatment planning. Additionally, a more complete appreciation of periodontal risk factors, as well as a better understanding of growth and development, will affect the timing and sequencing of a treatment plan. In this issue, we present a collection of articles that will challenge our perceptions of the treatment-planning process.

The first article by Dr. Don Curtis and co-authors is a synopsis of factors that affect treatment planning. The realities of how insurance coverage, patient/clinician interactions, and subtle media messages affect treatment planning are reviewed. In addition, scientific advances and the impact of those advances in the areas of biomaterials, prosthodontics, periodontics, and orthodontics will be outlined with the goal of providing updated information that the general dentist can use to develop a more cohesive treatment plan.

The second article, written by Dr. C. Pettengill and co-authors, emphasizes the

importance of a systematic assessment of a patient's psychological profile. When a clinician is first evaluating a patient's personality, his or her initial impression or gut instinct is often correct; but a systematic approach offers a more predictable evaluation. The authors outline psychological traits, a medication profile, and other features that will affect treatment-planning decisions.

The third article, by Drs. R. Kao and K. Pasquinelli, discusses the importance of "thick versus thin" periodontium in restorative treatment planning. In this article, the impact of gingival tissue anatomy on the periodontal diagnosis, treatment, and prognosis will be outlined. How the quality of the gingival tissue responds to restorations will also be outlined. A practical appreciation of the soft tissue response is important when treatment planning.

The fourth article, by Dr. G. Conte and co-authors, describes how implants can effectively replace failing dentition in the maxillary anterior esthetic zone. These authors describe criteria and treatment options that the restorative dentist should consider for achieving the optimal result. This article will provide the restorative dentist with an appreciation of soft and hard tissue considerations needed to provide an esthetic environment for the implant-supported prosthesis.

Lastly, Dr. J.J. Salehieh and co-authors review the importance of the "team approach" in esthetic dentistry. To achieve optimal results, the restorative dentist needs to perform appropriate case analysis as well as coordinate the "preparatory" procedures to be provided by the various specialists in the field of periodontics, orthodontics, and oral and maxillofacial surgery. This article provides the general dentist with an approach when coordinating treatment plans for patients with esthetic dentistry needs.

We hope these papers will stimulate the readership to consider the importance of treatment planning when providing patient care. This should be a very exciting

period for clinicians because of the rapid improvements in materials, techniques, and technologies. Treatment-planning concepts and philosophies need to reflect these changes.

# Treatment Planning in the 21st Century: What's New?

DONALD A. CURTIS, DMD; ALTON LACY, PhD, DDS; RAY CHU, DDS; DAVID RICHARDS, DDS, PhD;  
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**ABSTRACT** Many variables affect treatment planning, and it is important for clinicians to consider why they plan certain procedures for patient care. New materials, technologies, and products are constantly being introduced and affect decision making in dentistry. In addition, patients are more informed, have higher esthetic concerns, and want a greater stake in treatment planning decisions than ever before. How dentists treatment plan needs to reflect the many influences on final treatment outcome. The purpose of this paper is to outline how treatment planning has changed in dentistry with the goal of providing the general dentist updated information to develop a cohesive treatment plan.

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**T**reatment planning has become increasingly complex because the patient often requires multifaceted and sequenced care and because more patients have high esthetic expectations. Often, several specialties need to be coordinated over an extended period to manipulate the hard and soft tissues for optimal results. Additionally, the number of treatment options for a given dental problem has dramatically increased. Successful treatment planning must carefully consider the numerous influences on treatment outcomes, incorporate dental advances, and sensibly attempt to fulfill the wants as well as the needs of the patient.

The purpose of this review is to provide the general practitioner with a synopsis of how treatment planning has changed in

the past decade. Scientific advances and the impact of those advances in the areas of biomaterials, prosthodontics, periodontics, and orthodontics will be outlined with the goal of providing updated information so the general dentist can develop a more cohesive treatment plan.

## General Considerations

The approach used by clinicians to develop treatment plans changes throughout their careers and is influenced by factors clinicians can control, such as the gathering of clinical information or the choice of specialists available, and those they have less control over, such as insurance payments or the affordability of treatment. Treatment planning for recent graduates is most influenced by the materials and techniques taught in dental



school. Dental school training offers a conservative but predictable approach for many clinical procedures and provides a foundation for future professional growth. Initial training is modified by clinical experience, continuing education, study clubs, new product development, and treatment successes and failures.

Treatment planning has traditionally been specialty-based using different classification systems that make a comprehensive plan difficult to integrate. For example, classification in periodontics focuses on degree of disease (gingivitis versus periodontitis) while prosthodontics is related to anatomic classification (Kennedy Class I versus Class II) and orthodontics to tooth and arch relationship (Angle Class I vs. Class II). Because specialties focus on specific aspects of treatment and classify patient data differently, an integrated treatment plan that provides a measure of complexity is lacking. Some classification systems have been developed that classify clinical findings according to complexity, allowing better integration of specialty data, but these classification systems have not been widely accepted.<sup>1,2</sup>

Treatment planning and acceptance of a plan are influenced to a large degree by the cost of treatment and corresponding insurance coverage. The proposed treatment must be affordable to the patient and remunerative to the provider. In many situations, the sequencing of treatment is staged to maximize insurance coverage. While staged or quadrant dentistry has become the norm for treating patients who want to maximize insurance benefits, it does not always reflect the ideal approach or proper treatment sequence. For example, a patient with extensive dental needs and limited insurance benefits may desire to have the more visible anterior crowns completed first although the posterior crowns may have a higher functional priority. Treating the anterior teeth first may be a mistake, especially if the patient does not follow through with the posterior crowns. The

Dentists Insurance Company has stated that malpractice suits have occurred in clinical situations equivalent to the above example.<sup>3</sup> A rational treatment plan cannot be subverted to meet unrealistic patient demands or to maximize insurance benefits.

The public perception is that dental insurance should pay for the treatment of dental diseases; however, the reality is that most insurance plans provide inadequate benefits for effective treatment of dental diseases, whether the treatment is innovative or even considered the standard of care like implants. The increase in the number of insurance plans and third-party payers clearly influences (and will continue to influence) the treatment planning process, irrespective of all other factors outlined in this article.

Treatment planning has been influenced by a changing patient/clinician relationship as well as by media messages that promote and highlight cosmetic dental care. The interaction between the clinician and patient in developing a treatment plan has changed because the patient is often more knowledgeable about treatment options and often wants some degree of ownership in treatment decisions. Although the historically autocratic outline of treatment options from the clinician is still acceptable in certain situations, most patients want a collegial discussion to develop a treatment plan.

The public is told in subtle and not so subtle media messages that an attractive smile is not solely the product of genetic good fortune, but rather can be developed through creative dental treatment. Television and advertisements in popular health and beauty magazines promoting the use of tooth whitening agents has heightened public awareness of the cosmetic benefits of dental care. These media messages make it clear to consumers that contemporary dental treatment goes beyond the management of dental disease. Images of models with beautiful, well-aligned white teeth adorn the covers of the popular magazines that decorate

the supermarket checkout areas. Dental practices that include esthetic procedures in addition to traditional therapies for managing dental diseases draw from an expanding menu of treatment options. Dental “wants” now compete with dental “needs” for the dentist’s time and effort. The upshot of this trend is greater patient involvement, interest, and knowledge of treatment possibilities, which requires the dentist to carefully counsel patients on a prudent treatment plan.

### Biomaterials and Treatment Planning

In the past decade, dentists have witnessed a virtual explosion of new materials and improved dentin bonding; and they have gained a better understanding of materials biocompatibility. The public’s desire for tooth-colored restorations, coupled with continuing fears, justified or not, about adverse effects of dental amalgam restorations, has led to the development of durable composite resins and effective techniques for direct placement of these materials in posterior teeth. Contemporary composites are strong, durable, and no longer seen as inferior restorations for posterior teeth in selected situations. The potential of modern composite materials to strengthen teeth that have been weakened by previous amalgam restorations makes them both visually and functionally attractive treatment options.

A more conservative treatment planning approach is possible with improved bonding methods and fluoride-releasing materials. The cariostatic potential of fluoride-releasing cements has been validated through clinical experience and laboratory research.<sup>4-7</sup> Improvements in the physical properties of glass-ionomer and resin-ionomer materials permit conservative, minimally invasive restoration of caries and functionally acquired defects in the teeth. The adhesive properties of these materials allow retention of ionomer restorations with very little or no tooth preparation.<sup>8,9</sup>

This conservative approach is provided to prevent a positive advancement compared to the relatively aggressive tooth preparation that was required to mechanically retain most restorative materials two decades ago.

The operative concept of “extension for prevention” has given way to treatment plans oriented to “prevent the extension” by eliminating the need for many invasive restorative procedures. For example, the effectiveness of occlusal sealants in preventing caries is well-documented in the dental literature.<sup>10-12</sup> This ultraconservative therapy is provided in advance of the appearance of disease as a preventive measure.

A better understanding of the biocompatibility of dental materials has dramatically improved the strength of dentin bonding procedures. For example, it is well-documented that acid contact with dentin does not result in pulpal death as was universally thought 20 years ago.<sup>13,14</sup> This discovery coupled with research into the ultrastructure of dentin has led to successful techniques for bonding resin materials to dentin as well as enamel. This has had a powerful impact on the development of esthetic dentistry and expansion of the menu of treatment modalities available to the patient.

Recognition that eugenol inhibits polymerization of dental resins has led to a sharp decline in the use of eugenol-containing medicaments and restorative materials.<sup>15,16</sup> Dental science has shown that the health of the dental pulp depends more upon disinfection and isolation than upon medication.<sup>17-19</sup> A better understanding of pulp biology and an awareness materials biocompatibility have resulted in more-predictable procedures when developing a treatment plan.

Twenty years ago, all-porcelain crowns were rarely used due to difficulties in achieving a precision fit, their capacity to abrade opposing teeth, and the high frequency of fracture. Porcelain-fused-to-metal crowns predominated because of their improved durability and reasonable

esthetics. Unfortunately, the potential of the PFM crown to mimic the appearance of natural teeth is limited by the presence of opaque porcelains that hide the metal and reflect light differently than natural teeth. The durable bond of composite resin to etched porcelain coupled with new high-strength, lower-fusing porcelains has opened new doors of opportunity for fabrication and placement of thinner, stronger, more natural looking all-porcelain crowns and veneers that are less abrasive to opposing dentition. Conservative removal of only the enamel or superficial dentin permits maximum conservation of healthy tooth structure and preservation of the health of the dental pulp.

### Prosthodontics and Treatment Planning

Treatment planning in prosthodontics has changed dramatically in the past decade because of the acceptance of dental implants as a viable long-term option to replace missing teeth. Although various types of dental implants have been used for centuries, it is only in the past couple of decades that predictable results have been achieved in both partially and completely edentulous patients. With the increase in the predictability of implants come treatment planning questions as to when to use conventional prosthodontic procedures and when to consider implant prosthodontics. The purpose of this review is to outline how the implant option has influenced clinical decision making in prosthodontics.

Prosthodontic treatment planning has changed because it is no longer appropriate to consider high-risk procedures when a more predictable alternative such as an implant is available. Higher risk endodontic or periodontal procedures to save teeth for prosthodontic abutments are of questionable value because of the predictable alternative of dental implants. For example, procedures such as root amputations or hemisections, which have a five-year failure rate of between 30 percent and 50 percent, are less frequently considered now that implants

are available.<sup>20-22</sup> Treatment that includes long-span fixed partial dentures or multiple splinted teeth should be carefully compared to the implant alternative. Additionally, endodontic procedures such as an apicoectomy or retrofills should be considered carefully not only because of the limited benefit, but also because of the possibility of compromising a potential implant site. Periodontal procedures such as crown lengthening should also be considered in that a reduced bone volume may compromise both the hard and soft tissue for a future implant site.

A commonly encountered clinical situation that requires a prosthodontic treatment planning decision is when a patient presents with a broken down molar that will require extensive therapy to restore. Restoration of the tooth may require a root canal, crown lengthening, a build-up restoration, and placement of a crown. The alternative would be to extract the tooth and place a single-tooth implant. The question becomes a comparison of the cost, time, and efficacy of restoring the tooth or placing an implant.

When comparing the relative merits of restoring a broken down tooth versus extracting the tooth and placing an implant, both the surgical and restorative success rates over various periods need to be compared. Unfortunately, current literature evaluating the success rates of root canal therapy on molars is lacking. Older literature has shown a five-year success rate of root canal therapy to be between 90 percent and 92 percent for vital teeth and slightly less for nonvital teeth.<sup>23,24</sup> This can be compared with the five-year osseointegration success rate with an implant, which ranges from 93 percent to 98 percent.<sup>25,26</sup> The complication rate of a crown on a tooth is lower than a crown on an implant; <sup>27</sup> however, in many situations a single-tooth implant will be the treatment of choice.

A second clinical situation that requires a prosthodontic treatment planning decision is when a patient is missing a tooth and the restorative dentist needs to

consider a FPD or single-tooth implant. A FPD to replace a missing tooth has several advantages, including high patient acceptance, relatively favorable insurance coverage, a comparatively short treatment time, and experienced laboratory support. In addition, the dentist has had previous formal training in FPD procedures.

Fixed partial dentures have been shown to be a very satisfactory solution to replace a missing tooth. A recent review of fixed partial denture survival by Scurria and colleagues showed an 87 percent 10-year survival rate and a 69 percent 15-year survival rate.<sup>28</sup> The abutment tooth survival rate at 10 years was estimated to be 96 percent, but drops off rapidly after that.<sup>28</sup> The primary cause of failure was a loose retainer, and the second most common cause was recurrent caries. Bragger and colleagues compared the frequency of biologic and technical complications in 85 patients with FPDs on natural teeth over a five-year period and found biologic complications to be caries (2.8 percent), endodontic problems (4.9 percent), and periodontal problems (4.1 percent).<sup>29</sup> The most common technical complication was porcelain fracture, which occurred in 6.1 percent of patients.<sup>29</sup> Important factors to consider before treatment planning for a fixed partial denture would be the condition of the proximal teeth, the potential for the loosening of abutments, and the patient's ability to avoid caries or periodontal problems through adequate oral hygiene. A patient at high risk for complications with a fixed partial denture should be considered for a single-tooth implant.

The traditional disadvantages of treatment planning with dental implants are of decreasing significance. For example, implants can be completed in a one-stage procedure more predictably, thereby avoiding a second surgery. Additionally, improvements in the implant surface result in faster osseointegration and decreased treatment time. Limited bone availability is less of a factor now that there are better grafting materials and techniques for site

preparation that can include orthodontic extrusion, distraction osteogenesis, or onlay grafting.

### Periodontal Assessment and Treatment Planning

The goal of this brief outline is to focus on areas of periodontal treatment planning that have changed in the last decade. Risk assessment, tissue preservation, and tissue reconstruction will be reviewed with the goal of integrating these concepts to develop a coherent periodontal treatment plan.

#### Local and Systemic Risk Assessment

The goals of periodontics have been to halt attachment loss due to disease, regenerate attachment when possible, and provide stable elements for the restorative dentist by assessing the risk of failure in restoratively critical teeth. With the increasing use of implants to replace missing teeth, reliance on the periodontist to provide stable abutments and retainers has decreased. Missing teeth are now more appropriately replaced with implants rather than fixed partial dentures, and implants are also used to support removable partial dentures, making the restorative dentist less reliant on the periodontal prognosis of questionable teeth.<sup>30</sup>

The periodontally compromised tooth can now generally be considered in isolation, no longer serving the crucial role of supporting its missing neighbors. Now it is not prudent to maintain endodontically and periodontally compromised teeth when they can be replaced with implants, and the timing of extraction must be considered differently if implants are to be considered. In addition, esthetics play a greater role in decisions regarding compromised teeth. Both of these issues will be explored in a later section on tissue preservation.

Furcation involvement remains the most important single tooth risk factor in predicting the outcome of treatments.<sup>31</sup> During the past decade, the concept of tissue regeneration has been put into everyday practice and its promises and limitation explored.<sup>32</sup> While guided tissue

regeneration has been successful for some furcation involvements, others have not responded well to this therapy.<sup>33</sup> Initially, it was used in nearly every possible situation, but an appreciation of the limitations of this technique has forced clinicians to be more selective.

The 1996 World Workshop in Periodontics listed three bacteria as risk factors for periodontal disease.<sup>34</sup> Despite this finding, treatment planning has not changed. Few practitioners are willing to culture the oral flora and identify targeted organisms when developing their treatment plan. This is unfortunate since certain periodontal diseases have unique manifestations due to their microflora. Therapy based on targeting specific bacteria may be more successful and potentially result in less surgery. These changes, albeit small, have set the stage for consideration of virulence in the bacterial population, and the sequence of the genomes of these organisms will likely result in further changes in treatment planning.

If furcation involvement is the most important single tooth factor in periodontal risk assessment, then smoking has become the most important overall risk factor.<sup>35,36</sup> Recent information about the effects of smoking on periodontal health has come to light; and, with its effect on implant survival and guided tissue and bone regeneration success, this behavior becomes paramount in predicting the outcome of disease in periodontal patients.<sup>36,37</sup>

Another important factor that has surfaced in the past decade is the certainty that genetic makeup is critical in determining periodontal disease patterns in the population. An important piece of evidence is the identification of genetic markers for the host response that can now be categorized as risk factors.<sup>38</sup> While the single marketed product (PST) still remains controversial,<sup>39</sup> there is little doubt that this test and others like it will form critical aspects of treatment planning and prognostication in the future.



Another change in treatment considerations in periodontal therapy that has occurred in the past decade is greater inclusion of systemic diseases in considering the outcome of disease in individuals with these conditions.<sup>40</sup> Diabetes has been known to cause a greater expression of the periodontal disease process for more than the past 10 years; however, greater understanding of this disease and how periodontitis is influenced by it allows for some modification in treatment planning for diabetic patients. It has also been confirmed that periodontal disease may affect the expression of diabetes;<sup>41</sup> and, with this concept in mind, the effect of periodontal disease on other systemic illnesses has been explored in the past decade.<sup>42</sup> Heart disease, pregnancy, and respiratory disease have been implicated as having an effect on periodontitis. These associations have not affected periodontal treatment planning per se, but may contribute to more patients being treated for periodontal disease than before.

Other systemic conditions that are now being considered as periodontal risk indicators are osteoporosis and estrogen deficiency, and these do tend to alter the way periodontal disease is treated.<sup>43</sup>

### *Tissue Preservation*

Tissue preservation has become a unifying concept in periodontal treatment planning. Previously, an assessment may have focused on whether a tooth would be a reliable or unreliable prosthetic abutment. With dental implants now a treatment option, the clinician must decide whether retaining a periodontally questionable tooth will result in more alveolar bone loss. This may limit or eliminate the future use of a dental implant. The concept of strategic extraction to preserve adequate tissue for dental implants is a key determinant for treatment planning. This approach is highly influenced by clinicians' ability to preserve and regenerate soft and hard tissue in preparation for dental implants.

Tooth removal must be carefully planned to preserve as much of the soft and hard tissues as possible not only to create the best esthetic result, but also to ensure the most functional and long-lasting results. It is now uncommon to remove an anterior tooth without considering preserving the ridge regardless of whether the missing tooth will be restored by a fixed partial denture or an implant.

A number of recent technologies and practices come into play in the implementation of these therapies. Guided bone regeneration, the use of membranes, and plasma-derived growth factors are the most common strategies employed. As these and other products of the biotechnology revolution continue to be introduced, clinicians' ability to preserve and reconstruct the periodontium and alveolus will improve.

### *Tissue Reconstruction*

Esthetics and function also drive the reconstruction side of periodontal treatment planning. The two focal points of reconstruction are the root surface and the alveolar process. In the past decade, the regenerative capabilities of the periodontium have been researched and are being used in practice. Biomimetics, genomics, and bioengineering have made some changes in the way we approach the treatment planning of periodontitis.

In many cases, the root surface ligamentous attachment can now be predictably rebuilt after being lost due to periodontal disease or trauma. However, this therapy may possibly have been exhausted in the last decade. Although there continue to be indications for its use,<sup>44</sup> as its limitations have been exposed, it is no longer as widely employed as it was in the 1990s. Many of the products that were developed for use with this treatment, however, have ended up being used in the practice of guided bone regeneration and root coverage.

Root coverage techniques have become remarkably predictable, and their use

has therefore become more widespread. There is still some controversy regarding the minimal amount of gingiva necessary to prevent recession; but, given the opportunity to rebuild lost tissue, most dentists and patients will choose these techniques.<sup>45</sup>

The need for a complete alveolar process unites esthetics and function again. When maxillary anterior teeth are lost, it is imperative that tissue preservation techniques are used to retain as much of the normal architecture as possible, and when this preservation fails or is neglected (see article this issue), reconstructive techniques must be used.

Surgeons in the treatment planning process now occupy a new role; they must assess the ability of the remaining ridge to accept a dental implant or implants and provide or reconstruct a ridge that will accept implantation. All types of bone grafting strategies are now being used, which will prompt future advances in bioengineering and biological response modifiers. Autogenous and allogenic onlay grafts and a variety of sinus floor alterations along with membranes and growth factors are currently being used, and these strategies will soon become universal.

The biotechnology industry has always been an integral part of the dental marketplace. However, with the explosion of information, there is a lot more to consider in any one treatment approach. There will continue to be a myriad of diagnostic tests. The opportunity for companies to sell products designed to regenerate bone and attachment has greatly increased. Some of these offerings seem nearly magical in nature, and others are akin to snake oil. It is a constant struggle for the clinician to separate the wheat from the chaff when it comes to these products and services.

In conclusion, some of the vital things that have not changed in periodontics are identification of specific periodontal pathogens, effective management of furcation involvements, and proper

diagnosis of disease activity or attachment loss. These factors profoundly affect the clinician's ability to accurately assess the prognosis of individual teeth. What has changed is an improved understanding about smoking, genetic predisposition, estrogen deficiency, osteoporosis, and diabetes, and the relationship of these systemic conditions to periodontal health. Esthetics and ridge preservation must also be considered more than ever before. But the most important change in periodontal treatment planning is the strategy that the patient's needs can best be served by the judicious removal of periodontally compromised teeth and replacement with dental implants.

### Orthodontics and Treatment Planning

The past two decades have brought significant changes to the practice of orthodontics. Treatment is no longer reserved only for the juvenile and adolescent age groups. The advent of more esthetic and socially acceptable brackets, advancements in wire technology resulting in longer appointment intervals, and better insurance coverage for orthodontic services have significantly broadened the age spectrum as well as the scope of orthodontic treatment. On one end of this spectrum, orthodontic treatment is beginning at a much younger age than ever before; on the other end, adults and even the elderly are seeking orthodontic treatment as a critical part of the solution to their overall oral rehabilitation.

There is now greater emphasis on proper timing for early orthodontic intervention. Most orthodontic referrals used to be made when all the primary teeth had exfoliated. Children were generally seen for their first orthodontic examination around age 12 or 13. Consequently, there was little opportunity for any growth modification, habit elimination, or arch development; and crowding in most cases was resolved by extraction of teeth. Many warning signs of developing malocclusions appear in the early mixed dentition. This recognition

has resulted in much earlier screenings. Ideally, children should be screened for orthodontic treatment no later than age 7, when the six-year molars and most of the upper and lower incisors have erupted. This allows the orthodontist to assess the anteroposterior, transverse, vertical, and functional relationships of the jaws. In addition, arch length discrepancies and habit patterns can be evaluated. Referral for an orthodontic screening at age 7 does not always result in immediate treatment but allows the orthodontist to determine how and when the child's particular problem should be treated for maximum improvement with the least amount of time and expense. Although growth-related and skeletal problems must be addressed early for maximum benefit, many orthodontic problems can wait for treatment until appearance of the late mixed dentition or permanent dentition.

There has been a major paradigm shift in orthodontic diagnosis and treatment planning. The goal of the orthodontist is no longer just to fit the teeth within the dental arches at all cost. Contemporary orthodontists now strive to attain facial esthetics, dental esthetics, periodontal health, optimum functional occlusion, temporomandibular joint health, and long-term stability. Proper tooth positioning is now more than ever before dictated by what the face and the periodontium allow. Therefore "extraction" and "non-extraction" are no longer considered treatment goals but are merely treatment plans intended to place the teeth in a periodontally stable position within a well-balanced face.

Furthermore, what was considered a beautiful face in the 1960s differs significantly from what is considered beautiful today. A simple comparison of today's fashion magazines with those of 40 years ago clearly indicates that facial esthetic criteria have been redefined in response to ethnic and cultural diversity. Many of the commonly used cephalometric norms that were obtained based on North American Caucasian subjects render themselves useless in planning treatment

for today's diverse and heterogeneous patient population. There is also raised awareness of the importance of soft tissue response to orthodontic treatment and orthognathic surgery. Many of the more contemporary cephalometric analyses have been designed based on soft-tissue objectives and how skeletal and/or dental movements affect the soft tissue.

Advances in digital imaging and radiography have significantly facilitated diagnosis and treatment planning. Many orthodontic software programs have been developed to aid orthodontists in simulating various treatment possibilities, allowing them to better educate their patients about expected results and provide proper informed consent. These simulations, referred to as visualized treatment objectives, which were quite tedious to do before computerization, test the feasibility of various treatment plans and the effect of the proposed treatments on appearance. This can be particularly powerful when surgical and nonsurgical options are being compared.

With more adults seeking orthodontic treatment than ever before, orthodontists find themselves instrumental members of a multidisciplinary team. Adult treatment can pose several challenges. Many adults seeking orthodontic treatment present with several dental problems including abraded or worn teeth; peg-shaped or atypical teeth; old, failing restorations; multiple edentulous spaces; tipped teeth; congenitally missing permanent teeth and over-retained deciduous teeth; recession and periodontal breakdown; and temporomandibular disorder. Coordination and proper sequencing of treatment with other specialists is essential for a successful treatment result. Implants have not only become a viable restorative option to replace missing teeth, but have also opened up many orthodontic possibilities. Implants have proven to be an excellent means of providing anchorage in the edentulous spaces to make tooth movement possible elsewhere within the arch.

Despite inconsistent and questionable literature on the correlation between occlusion and TMD, condylar stability prior to initiation of orthodontic treatment is considered an important prerequisite for proper diagnosis and treatment planning. For the dentist to avoid surprises, TMD must be controlled prior to starting orthodontic treatment. A mutually protective occlusion with centric occlusion and centric relation as coincident as possible has become an ideal goal.

Although insurance coverage for orthognathic surgery continues to pose a challenge, more adults are considering surgery to correct skeletal malocclusions. The use of rigid fixation in lieu of intermaxillary wire fixation has significantly improved postoperative comfort and long-term stability. Furthermore, recent refinements in distraction osteogenesis have made possible the correction of extremely severe skeletal malocclusions that would have failed in response to conventional surgical orthodontics.

The addition of transparent aligners to the orthodontist's armamentarium has opened up many possibilities for adult treatment. For adults who have always wanted straight teeth but have been resistant to braces, this has been a dream come true. These transparent aligners have been effective in correcting mild to moderate crowding and spacing problems in permanent dentition. Aligners are also being used in combination with braces to correct more-difficult cases while minimizing time in fixed appliances. Proper case selection is critical for a successful result. Although this new technology still has several limitations, it is showing great promise and is being explored further.

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# Understanding Your Patient from a Psychological Perspective: Early Identification of Problem Behaviors Affecting the Dental Office

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**ABSTRACT** Early assessment of problem patient behaviors can be a complex and time-consuming task. These negative behaviors can frequently interrupt and misdirect treatment goals. Most dentists, due to private practice demands, do not have the time and training to assess these behaviors. The emotional stability of each patient is taken for granted. Subtle negative behavioral clues can be detected during medical history taking and the initial patient interview. Current prescription medications can also provide clues concerning past or current treatment for depression, anxiety, psychiatric problems, or substance abuse. The burden of properly assessing behaviors and their impact on dental treatment rests on the dentist's acumen in history taking. All practices have some difficult patients. It is important that dentists recognize patients who have special needs such as those with high anxiety, dependency, depression, obsessional somatic focus, or prior negative dental experiences.

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**T**reatment success is the goal of every dentist. Unfortunately, there are situations in which the patient is unhappy even when the best possible results are achieved. With a training focus on perfectionism, many dentists can find these “failures” emotionally straining. These types of failures often arise from an inability to assess the psychological needs of the patient during treatment planning. Signs of unrealistic demands and/or expectations are often present but are subtle.<sup>1,2</sup> Unfortunately, dental education does not provide clinicians with enough experience to easily recognize these warning signs. With experience, dentists and their staff can learn to recognize some of these warning signs. However, are there easier ways of identifying the psychological needs of patients? This paper will help dentists and their staff develop a strategy for recognizing behaviors that may consequently result in treatment “failure.” Early identification of these patients permits the dentist to define limits and terms of treatment so that both parties can reach a mutually acceptable result.

It is clear that there is a small group of unusual patients who have difficulty following through on an agreed upon dental treatment plan. The reason for this behavior is usually emotional and may be evident from the first appointment.<sup>3,4</sup> These patients come to the office with a dental complaint and appear to appreciate being accepted as a patient. They often express gratitude for the advice received and the initial treatment plan. As time passes, however, the patient may slow and hinder treatment progress.<sup>2</sup>

These delays manifest themselves as:

- Repeated questions about the treatment plan after consent and treatment initiation;

- Impatience with the time frame originally agreed upon;
- Changing chief complaints;
- Poor tolerance of mild discomfort, adverse reactions, or uncommon side-effects;
- Doctor-shopping or seeking multiple consults during active treatment;
- Frequent attempts at self-diagnosis to direct treatment;
- Exquisitely detailed description of physical symptoms sometimes with idiosyncratic ideas about anatomy and physiology; and/or
- Clear preference for specific nonrecommended treatment over treatment recommended by the dentist.

These behaviors may negatively affect the dentist’s performance and delay treatment completion.

### Dental Practice Demands

Coping with difficult, uncooperative patients is considered a major stressor for dentists.<sup>3</sup> Patients are often anxious about dental treatment and the sometimes necessary local anesthesia.<sup>5</sup> In addition to a busy practice schedule, this situation places additional stress on the dentist and staff. While partial or full psychological evaluation of these dental patients may be indicated, the difficulty and time necessary for an evaluation of this type makes it unrealistic in a clinical dental practice.

In the presence of this stressful environment, it is often difficult for health care providers to take the time necessary to even recognize negative behavioral signs.<sup>6</sup> Failure to recognize these behaviors and identify these patients may result in increased stress during treatment, prolonged treatment time, miscommunication, ill feelings, and, in rare incidences, litigation.<sup>7</sup> Therefore, it is important to assess behavior and

psychosocial factors in the daily practice of dentistry to achieve treatment compliance and favorable outcomes.

### Emotional Requirements of Patients

Emotional instability can complicate and interfere with dental treatment. Clinicians generally perceive most patients as emotionally stable individuals with an interest in improving their health. Unfortunately, there is a subset of patients with behavior problems that make them difficult to treat. Some people with emotional and psychiatric disorders are not stable and have many oral health needs. Frequently these patients are treated successfully. However, it may take a dentist with more advanced training and knowledge to be successful with these patients. Assessing the nature and extent of these behavior problems requires time and energy. Assessment often requires a variety of psychological tests that are available for determining dental fear, stress, or depression. Administration of tests and interpretation of the results often require the expertise of a trained psychologist. Additionally, there is no test that will accurately identify who will comply with the treatment plan and cooperate with dentists and their staff. Dentists are often looking for a cookbook approach for recognizing and assessing these negative behaviors. However, this can only be done thoroughly through a psychologically based interview. Dentists can learn and develop skills to identify patients that may have difficulty developing a therapeutic working relationship.<sup>5,8</sup> Though this paper introduces some strategies for assessing these behaviors, dentists would benefit from taking postgraduate courses to develop these skills.

Dentists can easily identify emotional problems such as severe dental fear,

strong dependency needs, alcohol or drug intoxication, drug-seeking behavior, or paranoia. The medical and dental history will often help expose these problems. However, it is more difficult to identify obsessive behaviors that may focus on a variety of issues including the diagnosis or treatment, anxiety displaced on the occlusion, depression, and feeling harmed by a previous dentist or clinician. Other negative behavior problems include poor impulse control or overreaction to incidental events.

Patients can, in some cases, develop a somatic focus. This focus on their body can be manifested by an increased attention on microscopically small differences in their occlusion. This is often the result of displaced anxiety during or following dental treatment. This focus on occlusion becomes magnified until there is obsessive checking of the occlusion. As this behavior continues, the patient develops increasing doubts as to the quality of the work performed. This doubt elicits a greater perception that there are other problems or the treatment plan is unworkable.<sup>9</sup>

Uncontrolled depression cannot always be easily identified in the dental office. Physicians and dentists often miss moderate to severe depression because the patient may present superficially euthymic with a masked depression. Some patients do not feel comfortable communicating how they feel or are not willing to ask for help. Depression can result from a chemical imbalance, negative life events, and/or chronic pain. From the dentist's viewpoint, the depression may seem insignificant, but it can lead to a distorted perception and leave the patient feeling as if successful treatment was partly or completely unsuccessful.

Feeling harmed by a previous dentist's treatment can lead to difficulties in trusting the new dentist. When a patient loses trust in the profession, he or she often wishes to direct his or her own care. With readily available information at the library and on the Internet, patients can become quite educated about their

**Table 1. Health History Questions Designed With Behavioral Medicine Focus**

- Do you feel permanently harmed by a dentist or dental hygienist?
- Are there obstacles to cleaning or caring for your teeth?
- Do you have problems with eating (i.e., trouble chewing, vomiting, weight loss)?
- Do you have problems sleeping before dental appointments or in general?
- Do you feel pain anywhere in your body on a daily basis?
- Now or in the past have you ever had severe dental fear?
- Please rate your dental fear on a scale of 0 to 10, for 0 = no fear to 10 = most fear.
- Do you have loose teeth or are you worried about losing teeth?

problems. As a result, there may be competition as to who is in charge of the case. This is often evidenced in extensive questioning of the treatment plan, self-diagnosis, and self-directed treatment options that are often inappropriate. The best way to manage these patients is to be empathetic, yet firmly set limits, and discuss factual findings and realistic treatment options.<sup>10</sup>

Another possible problem is poor impulse control. Impulsive behaviors may be manifested as exaggerated emotional outbursts. This may be evident in the dental office when these patients have difficulty filling out forms, waiting in the reception room, tolerating minor discomfort involved in dental treatment, or become unreasonably argumentative with staff.

### Early Assessment of Patients

The first appointment is very important. A psychological interview may take additional time and energy, but it is worthwhile. During this time, the dentist can better assess the patient's behavioral as well as dental problems. Appropriate evaluation can result in the development of a treatment plan that is customized for the individual.<sup>11</sup> If there is no workable treatment plan and there are no treatment alternatives acceptable to the patient, he or she should not be accepted as a new patient. It is important to realize that acceptance of these patients may be emotionally demanding on the dentist and the staff.

There appear to be two kinds of

problem patient behaviors:

- Behaviors that emerge during the first appointment or before treatment has begun, and
- Behaviors that emerge at a point where treatment cannot be terminated without risking abandonment.

Specific questions can be asked in the medical and dental history questionnaire that are designed to identify complex patient behaviors (**TABLE 1**). For example, the patient can be asked "Do you have a physician you like and trust?" This question accomplishes two things at the same time. It identifies the physician of record and gives the dentist a preview of the patient's ability to form trusting relationships with health care providers. A history of few or no positive relationships with physicians or dentists suggests an inability to form a trusting relationship. It is unlikely that a patient would experience three or more "incompetent" health care providers either in the same discipline or sequentially.

Clinicians can also ask "What has your experience been like with dental and dental hygiene treatment in the past?" Patients who hesitate may be censoring their response or may not feel comfortable speaking negatively of a past clinician. If patients give an incomplete or vague answer, they should be encouraged to elaborate on what the dentist or hygienist said or did that left them feeling that the provider did not care about them. Sometimes listening for a pattern of similar complaints about previous dentists provides a sneak preview.

For cosmetic cases, there must be

mutual agreement between the dentist and patient regarding the patient's level of cosmetic acceptability. A question on the health history form regarding the color, size, and/or shape of the patients' teeth, or questions regarding previous cosmetic surgery such as a facelift, may provide clues to a somatic focus on appearance. Dealing with cosmetic expectations that may not be realistic due to congenital problems or dental material limitations is much easier in the beginning of the case. Communication with the patient on these issues may also flush out minor, inconsequential cosmetic demands that are not possible for any dentist to meet.

Also, current prescription medications noted in the medical history can be a clue to past or current treatment for depression, anxiety, psychiatric problems, or substance abuse. The major drug groups to be concerned about are antidepressants, antianxiety agents, and the antipsychotics (TABLE 2). In an extreme example, medications, such as lithium, used to treat bipolar disorder may indicate potentially difficult patients, especially if they stop the medication for any reason or the dosages have not been adjusted appropriately by their physician, eliciting problem behaviors.

Use of antidepressants such as tricyclics (e.g., amitriptyline), serotonin-selective reuptake inhibitors such as fluoxetine, and newer atypical agents such as venlafaxine, does not necessarily forecast a difficult patient. However, those antidepressants that are also indicated for the treatment of anxiety disorders (paroxetine, venlafaxine) or obsessive-compulsive disorders (fluoxetine, fluvoxamine, clomipramine) may signal a patient who will contact the health care system excessively. Such a patient may be overly concerned about specific treatments or cosmetic appearance, or may frequently voice somatic complaints. Even routine dental procedures may be regarded as provoking further oral problems. When gathering a medical history, the dentist should note the duration of the drug

therapy, particularly if multiple drugs were used, and pay careful attention to the necessity of changing therapy. However, some patients who have had repeated episodes of major depressive disorder or who have been diagnosed with dysthymia may require lifelong antidepressant therapy. If the medication and dose have been stable for at least six to nine months, the patient's depression is probably adequately managed.

Anti-anxiety agents include buspirone and the benzodiazepines (e.g., diazepam, clonazepam, etc.). In general, the latter agents should be used for short-term management of acute anxiety states, although it is not uncommon to encounter patients who have been maintained on benzodiazepines for several months or even years. Like anxiolytics, these medications may also signal a preoccupation with somatic symptoms or anxiety about treatments that are performed in the dental office. New or rapidly escalating doses of anti-anxiety medications can indicate a patient with uncontrolled anxiety, phobias, or panic disorder. It would be wise in these cases to discuss the management of anxiety with the prescriber, and to defer invasive dental treatment until the anxiety disorder is stabilized.

Antipsychotics are occasionally used in small doses for dementia and as augmenting agents to the antidepressants. These agents include risperidone, olanzapine, quetiapine, haloperidol, and older phenothiazine antipsychotics such as chlorpromazine. It is prudent to discuss

the use of these agents with the prescriber to ascertain the reason for their use as well as treatment response. If a patient is actively delusional, he or she is a poor candidate for dental interventions.

More recently, the anticonvulsants carbamazepine, divalproate, oxcarbazepine, gabapentin, and lamotrigine have been used as adjunctive agents in the management of bipolar disorder and some depressive disorders with or without anxiety. However, most of these medications are also used in the management of chronic pain syndromes, so the practitioner should understand the reason(s) for their use in any patient who presents for dental care and, as with the medication classes mentioned above, determine if the patient has obtained a therapeutic response. Lithium remains a popular choice for the management of bipolar disorder and should be respected in the same way as the previously mentioned medications. The appearance of any psychoactive agents in a patient's medication regimen does not automatically imply a poor response to dental treatment or a negative relationship with the dentist, but should be used appropriately to determine the relative response to therapy before any attempts at a therapeutic relationship are undertaken. A thorough history should include previous episodes of drug discontinuation and the reason for such discontinuation. Patients who habitually stop taking their medications without the advice or consent of the prescriber may be poor candidates for additional interventions.

**Table 3. Warning Signs-Patient Obstacles to Successful Treatment**

- Inability to commit to the defined treatment plan, with multiple and constantly changing complaints and/or constantly changing the treatment focus or the daily treatment scheduled
- Lack of consent to speak with previous dental providers and/or physician(s)
- Constantly late or changing appointments
- Frequently forgetting to take antibiotic premedication
- Frequent gagging during dental appointment/need to rinse mouth or other disruptions



**Table 4. Warning Signs for Consideration of a Behavioral Dentistry Consultation**

- Exquisite sensitivity to rejection by the dentist if all requests are not met
- Significant depression or anxiety distorting view of dental treatment
- Marked self-diagnosis despite dental diagnosis and comprehensive evaluation
- Frequent, urgent need for immediate attention to minor changes in symptoms or treatment response
- Voluntarily withholding of important medical history information putting dentist at risk
- Intense criticism of all past dentists matched with early, unearned praise of current dentist
- Patient report of multiple significant allergies or serious medical problems matched with refusal to follow through on relevant diagnostic tests

**Table 5. Warning Signs for Behavioral Dentistry Co-Treatment**

- Severe fear of needles or dental treatment
- Significant history of emotional, physical, or sexual abuse
- Exquisitely detailed obsessional focus on esthetics of teeth, face, or jaw
- Chronic (> 3 to 6 months) orofacial pain of moderate to severe intensity
- Feeling harmed by previous dental providers

Lastly, medications indicating a history of substance abuse can include disulfuram (alcohol), buprenorphine (opioids and other substances), methadone, levomethadyl, naltrexone (opioids), and bupropion (tobacco). A careful evaluation should be performed to determine the duration of therapy for any of these addictions, the risk of concomitant substance abuse, history of relapse or treatment failure, and evidence of compliance with the substance treatment program. Such evidence may be obtained by random urine or blood screening for substance abuse, as well as documentation of regular attendance for counseling and timely refills of the antiabuse medications noted above. Ethanol and tobacco abuse can interfere with the metabolism of a wide number of medications, while a history of opioid abuse may confer physical tolerance toward any prescribed analgesics. This is not to say that a patient with a past history of opioid abuse should be denied treatment; however, the prescriber should be vigilant in looking for signs of analgesic misuse following a surgical procedure.

The burden of properly assessing

medical conditions and their impact on dental treatment rests on the dentist's acumen in history taking and making use of available resources such as medical consultation. Patients often vary in their reliability as a historian. Therefore, medical consultation can be beneficial in understanding the patient's physical and emotional health. It is necessary to have the patient sign a consent form for the release of information from a physician. Then a phone call or letter written to the primary care physician might include a request for data such as:

- A list of all confirmed medical and psychiatric disorders present;
- A list of all prescribed medications and any compliance issues;
- A list of any known alcohol or drug use such that local anesthesia doses may need adjustment;
- A list of any contra-indications to local anesthesia; and
- Notations of any tendency toward self-diagnosis or excessive somatic focus. Most patients are more than happy to have their medical and dental team consult. Patients who will not allow

the dentist to speak to their physician present a problem. This behavior is one of many "warning signs," and follow-up by the dental team is important for a favorable treatment outcome (TABLE 3).

### Mid-Treatment Interventions for Problem Behavior

The treatment progresses, yet the patient has continuing doubts about the diagnosis and treatment plan, sometimes bordering on obsessional. If the treatment is going well and the patient is still unable to trust the dentist, it may not be that the dentist lacks interpersonal skill or rapport. A history of prior traumatic experiences could account for this significant level of distrust. There may have been emotional, physical, or sexual abuse (and/or combinations thereof) unknown to the dentist.<sup>12</sup> To address this issue, the behavior must be acknowledged. It is worthwhile to say, "I notice, and I'm interested if you notice, that you still wonder if the treatment is going in the right direction. Have we missed something? What has been your experience with trusting a doctor trying to take good care of you?" Identifying and labeling what is behind the patient's behavior makes it possible to work with the patient's anxiety.

At other times, patients may be needy and demanding to the extent that the office staff feels burdened. It may be necessary to bring the patient into the office and remark, "I notice and I wonder if you notice that you've called this office eight times this week and it's only Wednesday?" Waiting for the patient to admit that this is excessive is important. Following this admission, guidelines can be established on what is a significant reason to call and what issues can wait until the next appointment.

If patients decide midtreatment that they do not want to continue the treatment plan, the dentist should assess the risk and damage that may arise from discontinuing. Patients should be appraised of these risk and alternatives.

Alternative treatment providers should be recommended if continual care or alternatives are needed. Documentation of these consultations are essential for risk management against litigation.

When a patient is critical and dissatisfied, yet still wants to stay in the office, it is often because there is a hostile dependency. There is no working relationship between the dentist and patient, yet the patient fears the unknown so much, he or she prefers not to leave. If treatment has been performed to a point where it's possible to stop, it is time to sit down and ask the patient, "You seem uncomfortable and unhappy with the treatment I've provided you. It seems as if nothing has been right, yet you haven't said anything about moving your care to someone else with whom you might feel more comfortable."

Before considering patient termination, it is useful to understand the cause of the patient's problem behaviors. Most behaviors are aimed at mastery of some inner conflict. Typically patients are doing the best they can at the moment. Yet, there is no working relationship if they do not trust the dentist, are critical of everything that is done, and perceive the treatment to be harmful. This is a failing therapeutic relationship. A behavioral dentistry consultation with a mental health clinician can be especially helpful (TABLE 4). Co-treatment with a mental health clinician may be necessary for patients with complex or severe behavioral issues (TABLE 5).<sup>13</sup>

### Emotional Stability of Dentists

Dentists, along with all health care providers, have a responsibility to work with problem patient behaviors. Health care providers should not tolerate emotional abuse from a patient nor should they retaliate with verbal aggression. Positive self-esteem and emotional maturity give dentists the ability to tolerate patients who may be unappreciative or hostile. A strong emotional reaction to something the patient says or does is not warranted. The patient's comments

**Table 6. Dentist Obstacles to Successful Treatment**

- Missed confirmation of working diagnosis
- Lack of re-evaluation of working diagnosis if initial or prior treatment is unsuccessful
- Missed behavioral signs of severe anxiety, depression, or somatic focus
- Temptation to judge colleagues' work too harshly lacking context
- Missed signs of externalization of blame toward multiple previous dentists
- Feeling rushed or limited by patient such that relevant diagnostic tools or appropriate treatment options are not fully utilized
- Rescue fantasy that dentist can successfully treat this patient where many others have failed

and actions may be related to memories of someone in their past for whom they have strong negative feelings. Health care providers need to be aware that what they say or do may contribute to the patient's behavior.

For example, some dentists have a low tolerance for patients with needy, dependent behavior. In these cases, it is beneficial for the dentist to elicit these tendencies before treatment begins. It can be very frustrating for dentist when a patient first presents as a "good patient" only to change shortly after treatment has begun.

Dentists must also be aware of their own behavior as well as patients' manipulative behavior. Manipulative patients may bolster the dentist's ego with unwarranted praise and may be baiting the dentist to criticize previous clinicians (TABLE 6). Making good choices regarding what to say to the patient may help the treatment outcome of the case.

### Conclusions

Difficult patients are present in all dental practices. Therefore, it is important that dentists not reject patients who have special needs such as high anxiety, strong dependency, significant depression, obsessional somatic focus, or past negative dental experiences. Experienced dentists find creative ways to work with complex and difficult patients. Adding a few questions to the medical and dental history form can add a psychological dimension to patient contact. Answers to sensitive

questions about past experiences may yield information about patient stability. With additional information at the outset, it becomes easier to make a referral to a behavioral specialist or at least consider multidisciplinary treatment as part of the treatment plan. Patients with frustrating problematic behaviors may respond to intervention addressing the emotions behind this behavior. By addressing patients' emotional needs, the dentist may prevent a lack of acceptance of the treatment plan. Certain complex patients require a team approach in which the behavioral dentistry specialist can act as a patient advocate, addressing the emotional issues underlying these problem behaviors with support and counseling.

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Do you feel permanently harmed by a dentist or dental hygienist?

Are there obstacles to cleaning or caring for your teeth?

Do you have problems with eating (i.e., trouble chewing, vomiting, weight loss)?

Do you have problems sleeping before dental appointments or in general?

Do you feel pain anywhere in your body on a daily basis?

Now or in the past have you ever had severe dental fear?

Please rate your dental fear on a scale of 0 to 10, for 0 = no fear to 10 = most fear.

Do you have loose teeth or are you worried about losing teeth?

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Missed signs of externalization of blame toward multiple previous dentists

Feeling rushed or limited by patient such that relevant diagnostic tools or appropriate treatment options are not fully utilized

Rescue fantasy that dentist can successfully treat this patient where many others have failed

# Thick Versus Thin Gingival Tissue: A Key Determinant in Tissue Response to Disease and Restorative Treatment

RICHARD T. KAO, DDS, PHD, AND KIRK PASQUINELLI, DDS

**ABSTRACT** During the treatment planning process, it is important for clinicians to appreciate that the differences in gingival tissue can affect treatment outcomes. The concept of thick versus thin gingiva has previously been introduced. This concept has been expanded to describe the different ways these tissue types respond to inflammation, restorative trauma, and parafunctional habits. The resulting defects from these traumatic events will dictate varying treatment management modalities. As restorative dentists begin to appreciate the differences in gingival morphology, they will discover that working with thick gingiva is easier and more predictable. In the past, restorative dentists had no options for influencing the tissue quality they had to work with during restorative procedures. Recent advances in periodontal surgery have made it possible not only to reposition tissues to meet esthetic demands, but also to change the tissue quality of the restorative environment for more-predictable treatment outcomes.

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During clinical examinations, periodontal information-gathering tends to focus on quantitative information such as pocket depth, recession, mobility, and furcation involvement. Not enough time is devoted to evaluating the qualitative nature of the periodontium or, more notably, the gingiva. This is unfortunate since the quality of the gingiva will often define how restorations will appear esthetically. Additionally, it will provide the clinician with insight into

how periodontal defects result and what treatments are required. This paper will describe the importance of differentiating between thick and thin gingiva in the examination phase in preparation for treatment planning. Additionally, it will introduce a new paradigm shift.

The gingiva is that part of the masticatory mucosa which surrounds the cervical portion of the teeth and acts as the covering for the alveolar housing. Clinicians would all agree that an ideal healthy gingiva would be pink, be firm,





**FIGURE 1.** The ideal smile is supported by a thick gingiva with a stippled appearance. The gingival crest of the maxillary teeth follows the flow of the upper lip.



**FIGURES 2A AND B.** The clinical presentation of thick gingiva and the type of osseous architecture associated with this gingival tissue type.

be adjacent to the cemento-enamel junction, and fill the interproximal area fully (**FIGURE 1**). There is less agreement regarding what gingival features are risk predictors for periodontal breakdown. Quantitative descriptions of gingival recession or clefting are not consistently used nor fully appreciated. Qualitative gingival descriptors such as “minimal attached gingiva” or “thick versus thin attached gingiva” are seldom documented. Yet this information can be useful in telling the clinician which areas are at risk for periodontal breakdown in the presence of inflammation, restorative trauma, and parafunctional habits.

Why is gingival tissue quality important? The gingival tissue serves as the “picture framework” for a patient’s smile and restorative treatment. In this day of esthetic dentistry, it is paramount for the restorative dentist to consider how the gingival tissue is going to respond to both restorative margins and gingival inflammation. This appreciation may help clinicians find answers to past dilemmas such as why the gums receded on a recently cemented crown; why one extraction caused so much ridge atrophy while another did not; or why a new patient with generalized gingival recession appeared as if he had pocket reduction surgery despite the patient’s adamant denial. An appreciation of gingival tissue will also help clinicians have a better understanding of the periodontist’s viewpoints. This will encourage better teamwork and enhance patient treatment.

### The Difference Between Thick and Thin Gingiva

Historically, Ochsenbein and Miller<sup>1</sup> have discussed the importance of “thick versus thin” gingiva in restorative treatment planning. But what is this difference?

Thick gingival tissue is probably the image most associated with periodontal health (**FIGURE 1, TABLE 1**). The tissue is dense in appearance with a relatively large zone of attachment. The gingival topography is relatively flat with a suggestion of thick underlying bony architecture. Surgical evaluation of these areas often reveals

relatively thick underlying osseous form (**Figures 2a and b**).

Thin gingival tissue tends to be delicate and almost translucent in appearance (**Figures 3a through d, TABLE 2**). The tissue appears friable with a minimal zone of attached gingiva. The soft-tissue topography is highly accentuated and often suggestive of thin or minimal bone over the labial roots. Surgical evaluation often reveals thin labial bone with the possible presence of fenestration and dehiscence. Unlike thick gingiva, this tissue is highly sensitive to trauma and inflammation.

**Table 1. Characteristics of Thick Gingiva**

- Relatively flat soft tissue and bony architecture
- Dense fibrotic soft tissue
- Relatively large amount of attached gingiva
- Thick underlying osseous form
- Relatively resistant to acute trauma
- Reacts to disease with pocket formation and infrabony defect formation

**Table 2. Characteristics of Thin Gingiva**

- Highly scalloped soft tissue and bony architecture
- Delicate friable soft tissue
- Minimal amount of attached gingiva
- Thin underlying bone characterized by bony dehiscence and fenestration
- Reacts to insults and disease with gingival recession



**FIGURES 3A THROUGH C.** Clinical presentation of thin gingiva is characterized by thin friable tissue. It is associated with clefts, perforations, and gingival recession.



**FIGURE 3D.** The osseous architecture associated with this gingival tissue type is characterized by fenestration and dehiscence.

Classically, clinicians familiar with the concept of thick versus thin gingiva will describe a patient's gingival tissue quality as either a thick or thin case. This is true only when the gingival tissue is consistent. Frequently there are situations with regions of thick and thin gingiva. Since thick and thin gingiva is a gross description of the gingival-osseous housing complex, there is often a regional variation of labial plate thickness. Clinicians will see a mixture of thick and thin gingiva in the same dentition. Areas of thin labial plate are commonly associated with the canine eminencies, the mesial roots of maxillary first molars, and mandibular incisors. These areas tend to have thin gingiva. So for the clinician, it is better to describe the case as thick, thin, or mixed thick-thin gingiva. It is important to note the tissue quality in the region to be treated.

The quality of the gingiva may change depending on the age of the patient.<sup>2</sup>

For a young child 7 to 9 years old, the gingiva may appear thin with a minimal zone of attached gingiva. The zone of attached gingiva and volume will increase with growth, tooth eruption, and jaw development. After growth, the volume of the gingival tissue and the osseous housing remain relatively stable in health, but the width of the attached gingiva may continue to increase. Since the mucogingival junction remains stable throughout life, the increase in width is suggestive of slow eruption secondary to occlusal wear.

### Periodontal Response to Insult

Thick and thin gingiva will respond differently to infectious, restorative, and parafunctional insults (**TABLE 3**).

In thick gingiva, the gingival-osseous housing is comparatively thicker. With acute inflammation secondary to a periodontal/endodontic abscess, cracked tooth, or failing endodontic treatment, clinicians tend to see either encapsulation of the infection through abscess formation, venting through a parulis, or a perio-endodontic lesion through the periodontal pocket. Marginal inflammation can be described in the acute form as marginal redness to a chronic form that is magenta-cyanotic in appearance. With chronic inflammation, marginal gingivitis is present with gingiva coloration ranging from red to magenta. The gingiva may range from a normal shape to a boggy, enlarged shape. As inflammation persists, periodontal

pocketing tends to occur. In regions with a relatively thick bulk of bone, the pocket formation occurs in conjunction with infrabony defects. These defects tend to occur in areas where there is a large region of interproximal bone and on the labial/lingual aspect when tori are present. Surgical procedures are more predictable with thick gingiva. There is less postsurgical remodeling so the clinician can better predict tissue position. This is important in crown-lengthening procedures and extraction of teeth preceding implant placement. Lastly, the thick gingival-osseous housing makes this tissue more resistant to clinical and parafunctional insults such as toothbrush abrasion, the packing of impression cords, and poor restorative margins.

Thin gingiva responds differently than thick tissue. Acute insults such as trauma, fracture, abscess, or viral infection result not only in abscess/parulis formation, but also in the development of gingival recession/clefting. Rarely do these defects heal. With chronic periodontal disease, the marginal inflammation tends to be reddish in appearance. As inflammation persists, attachment loss occurs by gingival recession without significant pocket formation. This tendency toward gingival recession is significant for the clinician in terms of understanding how periodontal disease progresses differently in these patients and how these tissues respond to restorative procedures.

Monitoring of periodontal disease progression requires diligence on the



**FIGURES 5A-C.** Ridge preservation and augmentation have been performed in this case. Ridge deficiency is present in the #13 position from a previous extraction, and tooth #12 is planned for extraction. Volumetric increase in the gingiva was obtained with periodontal grafting for the #13 region, and ridge preservation was performed after extracting tooth #12. These periodontal procedures improve the gingival-restorative appearance to be more natural in appearance.

part of the clinician. Since dental training and record-keeping are largely focused on pocket depth, clinicians often will not fully appreciate periodontal disease progression in patients with thin gingiva. In these patients, disease progression occurs with an increase in gingival recession rather than pocket depth. In fact, these patients may appear as if they have had periodontal pocket reduction surgery because of the prevalence of gingival recession seen in patients following this type of surgery. Further questioning often reveals that they have never had advanced periodontal or surgical care. In these thin cases, it is critical for the clinician to realize that attachment loss is not only indicated by how deep the pockets are, but also by the amount of recession present. Frequently, pocket depth is insignificant in comparison to recession measurements.

Frequent analysis of attachment loss is important in thin cases. However, the manual recording of pocket depth and recession is so tedious that most clinicians only monitor pocket depth. Focusing only on pocket depth has the potential of giving one a false view that the patient is periodontally stable. With computer charting, attachment loss is easier to monitor; however, most software programs only record one recession measurement. Only with six-point pocket depth and recession measurements can one accurately monitor a patient's periodontal health status.

Gingival recession is a frequent clinical

finding in patients with thin gingiva. If a tooth is in buccal version, localized gingival recession can occur. Aggressive toothbrushing can result in a zone of gingival recession. This is most notable in teeth with buccal prominence, such as the cuspids and maxillary first molars. Regardless of whether the trauma is from toothbrush abrasion, eating, or localized recurrent aphthous ulcers or viral infections, these gingival areas are highly susceptible to recession.

#### Differential Management of Defects Associated With Thick and Thin Gingiva

Since the responses to infectious, restorative, and parafunctional insults by thick and thin tissues are different, the clinical management of these defects also varies (**TABLE 4**).

In thick tissue, acute infections are managed with curettage, irrigation with betadine solution (diluted 1:10 with water),<sup>3,4</sup> and antibiotics as needed. Chronic inflammation is managed with scaling and root planing. As periodontal disease progresses, deep pockets may be managed with flap osseous surgery. Associated infrabony defects can be managed by any combination of curettage, osseous contouring, and regenerative procedures. Crown lengthening procedures are relatively predictable with soft- and hard-tissue contouring as needed. With tooth extraction, ridge augmentation is often not necessary since there is adequate bulk of labial bone. In fact, grafting

associated with a ridge preservation procedure will often compromise implant osseointegration since grafted materials such as demineralized freeze-dried allografts do not readily resorb. Some of the graft materials remain amalgamated with the reparative bone and do not contribute to osseointegration.

In thin gingiva, the management approach is different. Both acute and chronic inflammation will result in gingival recession. The periodontal pockets are generally 2 to 4 mm deep. The definitive treatment for these cases often consists of scaling and root planing along with oral hygiene instruction. There are no pocket or infrabony defects that form because the thin bony plate resorbs in advance of the recession. Surgical procedures are also difficult since it is hard to predict the reparative result of the healing tissue. With crown lengthening and any flap osseous procedure, it is difficult to anticipate the final positioning of the thin soft and hard tissue, partially due to the fact that each time a surgical flap is reflected, there is at least 0.5 to 0.8 mm of bone loss.<sup>5,6</sup> With this loss, the thin labial plate recedes apically, and the soft tissue will follow. The extent of this recession is difficult to predict due to the varying thickness of the labial plate. Although a crown lengthening procedure may be necessary, it is important for the clinician to allow for more healing time so that the tissue can stabilize. This may require up to a minimum of six months or more for esthetically important areas such as the anterior maxillary





**FIGURES 6A AND B.** To minimize soft- and hard-tissue loss associated with tooth extraction, an immediate implant was placed.



**FIGURES 6C AND D.** An impression was taken such that a provisional temporary was placed to support the gingiva and adjacent papilla. Note that there was minimal tissue loss after six months.

segment. With extraction, the labial plate is prone to fracture. As the ridge heals, there is a tendency for the ridge to remodel apically as well as lingually. To prevent this, ridge preservation procedures such as guided bone regeneration and/or soft tissue grafting are indicated to minimize ridge atrophy. Further treatment to correct residual ridge deficiencies may include ridge augmentation procedures.

### Engineering a Change in the Periodontium

Based on the preceding discussion, it should be apparent that thick gingival tissue is easier and more predictable to manage restoratively and surgically. The literature on restorative treatment supports this finding. Until 10 to 15 years ago, restorative dentists had little choice in determining the type of gingiva with which they had to work. Recent advances in periodontal surgery have eliminated many of these constraints.

Restorative dentists now have the option of referring the patient to the

periodontist for corrective procedures. These procedures will develop the gingival environment into a “pseudo-thick” case. For areas with thin gingiva or gingival recession, a connective tissue graft procedure may be performed. This not only thickens the soft tissue so it is more resistant to trauma, but it can also cover exposed root surfaces (Figures 4a and b). When these strategies are used in conjunction with esthetic crown lengthening, it is possible for the periodontist to develop the gingiva volumetrically and in the apical/coronal direction to create the appropriate “framework” for restorative treatment. Similarly, the periodontist can manage extraction in the thin case with ridge preservation procedures to minimize ridge atrophy and/or ridge augmentation to correct ridge deficiencies (Figures 5a through c). In incidences where implants are desired, immediate implants can be placed to preserve not only the bone, but also the soft tissue, including the papilla (Figures 6a through d). These periodontal

procedures convert a thin case into a tissue type that the restorative dentist can work with more easily and predictably.

### Summary

A new paradigm shift has occurred in periodontics. In this new era, it is important for restorative dentists to consider the thick and thin gingival-osseous housing of the dentition. As clinicians begin to appreciate how thick versus thin tissues respond to infectious, restorative, and parafunctional trauma, they will be better able to predict the defects that will result and prescribe the appropriate treatment. Even more important for the restorative dentist is the realization that thick gingiva is a more favorable tissue environment for restorative procedures. With advances in periodontal plastic surgery, it is possible to transform a thin case into a more manageable “pseudo-thick” case. This paradigm shift will permit clinicians to be more effective in diagnosing periodontal problems and prescribing treatment. Additionally, these new procedures give them the ability to modify the tissue environment when they need to deliver esthetic restorations.

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# Considerations for Anterior Implant Esthetics

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**ABSTRACT** There are several factors to consider when restoring failing dentition in the anterior region. While a tooth can be replaced with an implant, achieving an esthetic result is challenging. The dental team must evaluate numerous criteria to define the optimal treatment plan. Among the considerations are whether to extract the tooth and perform immediate implant replacement or to perform a ridge preservation procedure. This article presents diagnostic determinants to help decide the most appropriate course of therapy to achieve functional and esthetic results.

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**T**he esthetic replacement of maxillary anterior teeth with an implant-supported prosthesis is now possible. The delivery of esthetic and natural-appearing crowns and/or bridges supported by implants requires careful and detailed treatment planning. This paper will describe steps that maximize the opportunity for delivering an esthetic implant-supported prosthesis.

Far too often, it is the natural inclination of the restorative dentist to expedite treatment by extracting failing teeth. Following extraction, a stayplate or a provisional bridge would be provided. Unfortunately, this may be a critical mistake. Without treatment planning that takes into account how the tissue will respond, the remodeling process will often

compromise the final esthetics. The papilla will be lost, and the alveolar ridge may remodel, thereby causing deficiencies in the apical and lingual direction.

The first decision to make is whether the failing tooth is needed for implant site development. The failing tooth may be useful in situations where significant bone loss is associated with the failing tooth but not with adjacent teeth. If one extracts the tooth, the bone level may be more apical relative to the adjacent teeth. This creates a difficult situation for impression taking and implant-supportive maintenance. As plaque accumulates at the implant interface, the inflammation may adversely affect the periodontal status of adjacent teeth. The ideal treatment is to delay the extraction so the failing tooth can be orthodontically extruded.<sup>1</sup> As this is done

over the course of six months, the bone and periodontal attachment surrounding the failing tooth will be coronally positioned to match adjacent bone levels. This provides more ideal bone height and allows the restorative implant platform to be placed at the desired height of 3 to 4 mm subgingivally. This paper will focus on situations where the failing tooth needs to be extracted and define key determinants for preserving hard and soft tissue for an optimal implant-supported prosthesis.

The ideal time to surgically place an implant is at the time of extraction. The implant will support and maintain the existing alveolar bone and soft tissue.<sup>2-4</sup> Immediately placed implants can be provisionalized at the time of implant placement or during the implant uncovering procedure.

Immediate implant placement with immediate provisionalization is ideal for preserving tissue integrity and satisfying patient demand for an esthetic provisional during osseointegration. In this situation, the abutment is attached to the newly placed implant and an acrylic crown is temporarily cemented. This provisional will support the soft tissue, including the surrounding papillae. It is important to ensure that the provisional is nonfunctional so that the implant is not prematurely loaded. Premature occlusal loading may interfere with osseointegration. This treatment provides the patient with the most esthetic provisional possible. It is crucial to emphasize the importance of not loading the area during mastication.

Alternatively, the implant surgical area can be provisionalized with a stayplate or bridge. If a stayplate is used, the pontic should be an ovate form and extend into the socket to support the soft tissue. Unfortunately, the movement of a stayplate can adversely infringe on the papilla. If possible, a better alternative is to use a fixed provisional bridge with an ovate pontic that extends into the socket. This extension will support the adjacent papilla and minimize soft-tissue loss. However,

despite the best effort to support the soft tissue with a stayplate or provisional bridge, marginal tissue remodeling and papilla loss will generally occur. This can compromise the final esthetics. This approach, though effective, does not usually provide the optimal esthetic outcome that is possible with immediate implant placement and provisionalization.

The last post-extraction situation is when an immediately placed implant is not an option due to significant loss of the labial plate. This loss can be due to surgical trauma, extensive dehiscence/fenestration, multiple episodes of parulis formation, and a weakened labial plate resulting from previous endodontic surgery. Since healing is unpredictable, this makes immediate implant placement a risky proposition. The treatment of choice in this situation is to perform a ridge preservation/augmentation procedure. In this situation, the goal is to preserve or regenerate the alveolar ridge so an implant can be placed later. Interdental papilla are usually lost, and the appropriate gingival crest level is often more apical than the contralateral tooth. These soft-tissue defects are often difficult, if not impossible, to correct surgically. Additionally, this approach is disheartening for the patient because it will delay treatment by three to six months.

Numerous options must be considered to achieve optimal esthetics with implant-supported prosthesis. It is important for the restorative dentist to realize that the best chance for maximizing the esthetics is to work as a member of an interdisciplinary team in analyzing which option is ideal. The restorative dentist needs to learn how to triage these patients and appreciate how the clinical information may favor one option over another. This paper will define diagnostic determinants and treatment-planning considerations for the esthetic restoration with an implant-supported prosthesis.

### Diagnostic Evaluation for Predictable Functional and Esthetic Results

There are several factors to consider

when planning an implant restoration of failed dentition in the esthetic zone. Most often, the esthetic zone involves the maxillary anterior dentition. Although the single-tooth implant-supported restoration appears simple to perform, it is the most challenging in the esthetic zone. One of the initial assessments is determining if the tooth in question is a candidate for immediate implant replacement or a ridge preservation procedure. This assessment will define the type of provisional that will be needed.

There are advantages to immediate dental implant placement. Research suggests that immediate implantation may preserve the alveolar bone, and placement of a fixture into a fresh extraction socket may help maintain the alveolar crest.<sup>2-4</sup> This can lead to an optimal esthetic outcome if specific diagnostic criteria are met. Immediate implantation may allow for immediate or early provisionalization, which can be used to help contour and shape the soft tissue at the restorative gingival interface (Figures 1a through i). In addition, treatment time can be reduced by three to six months if an implant can be placed at the time of extraction.

### Diagnostic Evaluation for Immediate Implantation in the Esthetic Zone

#### *Radiographic Assessment*

The diagnostic evaluation begins with a radiographic assessment of the failing tooth. Ideally, the tooth should be free of periapical and inter-radicular pathology. Should pathology be present, some believe that an immediate implant placement can be performed with the provision that all pathological tissue and adjacent bone are removed during the site preparation. When there are doubts or questions about whether infected tissue remains, the risk for non-osseointegration, loss through infection, or partial integration with delayed implant failure would make tooth extraction and ridge preservation a more prudent choice. The interproximal bone height should be at a normal level,



**FIGURE 1A.** Preoperative facial view demonstrates erythema along the labial free gingival margin of the maxillary left lateral incisor.



**FIGURE 1B.** Close-up view of the lateral incisor shows the red, boggy tissue. Note the thin scalloped periodontium.



**FIGURE 1C.** Periapical radiograph reveals a root resorptive defect on the distal of the tooth. There has also been apical root resorption. This provides a large quantity of bone apical to the existing root.



**FIGURE 1D.** Atraumatic extraction of the tooth. A periosteal elevator was used between the periodontal ligament space and the alveolar socket to sufficiently loosen the root. The tooth was removed without damage to the thin labial plate.



**FIGURE 1E.** Surgical stent used in preparation for implant placement. The stent was fabricated on a diagnostic cast based on radiographic analysis of the alveolar bone height and width.



**FIGURE 1F.** Implant placed in the proper buccal-lingual, mesial-distal, and apico-coronal position.



**FIGURE 1G.** Periapical radiograph of the implant with a custom temporary abutment used for the provisional restoration.



**FIGURE 1H.** Periapical radiograph of the implant with a custom temporary abutment used for the provisional restoration.



**FIGURE 1I.** Six-month view of provisional restoration. The interproximal papilla have been maintained, however, there has been a slight change in the position of the labial free gingival margin.

approximately 1 to 2 mm apical to the cemento-enamel junction of the adjacent teeth.<sup>5</sup> There must be sufficient bone beyond the apex of the failing tooth root to achieve primary implant stability (**FIGURE 1C**). If any of the above radiographic criteria are not met, the tooth should be extracted, and a bone graft and possibly a soft-tissue graft should be performed. The area should be allowed to heal for three to

six months. The healing period depends upon the extent of the labial defect and the rate of healing. Extensive loss generally will require four to six months of healing prior to implant placement.

#### *Soft-Tissue Assessment*

Soft-tissue assessment is most important in the diagnostic evaluation for implant restoration in the esthetic

zone. The existing gingival position of the failing tooth must first be evaluated. Approximately 1 to 2 mm of facial gingival recession may result following tooth removal and immediate implant placement.<sup>6</sup> Therefore, a hopeless tooth with a free gingival margin 1 to 2 mm more coronal to its contralateral counterpart is more favorable (**FIGURE 2a**). Conversely, a hopeless tooth with free gingival margin



**FIGURES 2A AND B.** The maxillary right central incisors in Figures 2a and 2b have poor prognosis due to root resorption. The tooth in Figure 2a is in a more favorable position for extraction and immediate implant placement because the free gingival margin is coronal to the contralateral tooth. In addition, the thick gingival biotype is preferred over the thin, scalloped gingiva seen in Figure 2b. Orthodontic extrusion prior to extraction and implant placement is recommended for the right central incisor in 2b.

positioned at the same level or more apical than its contralateral counterpart is not favorable because of the ensuing apical resorption that occurs with wound healing (**FIGURE 2b**). This is especially true if the patient has a high smile line. Under these conditions, orthodontic extrusion of the failing tooth prior to extraction is recommended.<sup>7</sup> The extrusion of the tooth will result in the development of both soft and hard tissue in a more coronal position. This allows the implant platform to be positioned where it can be managed prosthetically and during post-treatment supportive maintenance care. This method of tissue regeneration can compensate for the hard- and soft-tissue deficiencies to create a harmonious soft-tissue level as well as additional bone.

Next in the soft-tissue assessment is to evaluate the gingival scallop and gingival biotype. Gingival scallop has been categorized as flat, scalloped, and pronounced scallop, and is defined by the distance between the mid-facial and interproximal tissue height.<sup>8</sup> The biotype of the gingiva is typically considered as thick or thin. Based on clinical data, the average or normal gingival scallop is 4 to 5 mm.<sup>9</sup> Teeth with a normal or pronounced gingival scallop and a thin biotype are more prone to gingival tissue recession and interproximal tissue loss following tooth extraction. This is less likely to occur on teeth with a flat gingival scallop and a thick biotype<sup>9</sup> (Figures 2a and b).

Highly scalloped cases with a thin gingival biotype require special attention to ensure predictable peri-implant esthetics. In these cases, flapless surgical extraction and implant placement are advantageous because they minimize bone loss, which decreases gingival recession.<sup>11</sup> This procedure, however, is quite challenging due to lack of visibility and the thin labial plate of bone. It requires careful planning and flawless surgical execution. It may be optimal to extract the hopeless tooth, perform hard- and soft-tissue grafting, and place the implant three to six months later.

The final parameter in the soft-tissue assessment is the height of the interdental papilla. Interdental papilla height is determined by the position of the underlying osseous crest and the height of the interproximal contact area. In the normal dentogingival complex, interproximal papilla height is approximately 4.5 mm from the osseous crest.<sup>12-13</sup> The greater this distance, the greater the risk of tissue loss following extraction and immediate implant placement. This tissue is often difficult to re-establish, especially for the thin/scalloped periodontium. Therefore, maintenance of the interdental papilla is critical at the time of tooth removal by immediate tooth replacement using a fixed or removable prosthesis. The provisional restoration must support approximately 3 mm of unsupported soft tissue with gentle pressure that exerts laterally to support the

full height of the interdental papilla.

The height of the contact area with the adjacent teeth is also important in interdental soft-tissue height. In a clinical study of the natural dentition, it was determined that the presence or absence of interproximal papilla fill was inversely related to the distance from the base of the contact area to the underlying crest of bone.<sup>14</sup> At a distance of 5 mm or less, the papilla fill was present virtually 100 percent of the time. When the distance measured 6 mm, papilla fill was present 56 percent of the time. At a distance of 7 mm or more, papilla fill was present in only 27 percent of the sites examined.

#### *Hard-Tissue Assessment*

Numerous studies have established a relationship between the gingiva and the underlying bone for both the natural dentition and dental implants.<sup>8-12</sup> For immediate implant-supported restorations, the facial free gingival margin is supported by the existing facial bone of the failing tooth, and the interproximal gingival tissue is determined by the interproximal bone level of the adjacent tooth. Bone sounding under anesthesia is used to assess these dimensions and is an important and valuable diagnostic procedure prior to extraction. Normal relationship from the free gingival margin to the underlying osseous crest was found to have a facial dimension of 3 mm and an interproximal dimension of 4.5 mm.<sup>15-16</sup> If the facial gingival levels are harmonious between the hopeless tooth and the adjacent tooth, and the distance to the osseous crest is 3 mm or more, orthodontic extrusion prior to extraction would allow for a more favorable esthetic result. If the interproximal height to the osseous crest is greater than 4.5 mm, soft-tissue loss can be expected following implant placement and restoration. A common misconception is to measure the interproximal bone height of the failing tooth. It is, however, the interproximal osseous position of the retained adjacent teeth that will provide the foundation for interproximal tissue in the final





**FIGURES 3A AND B.** Examples of different tooth shapes. The maxillary central incisors in 3a are long and triangular with the contact area located incisally. The central incisors in 3b are square shaped with a long interproximal contact. This is more favorable for extraction and immediate implant placement.



**FIGURES 4A.** Tooth #6 has a hopeless prognosis.



**FIGURES 4B AND C.** On extraction, there is a perforation of the labial plate.



**FIGURE 4D.** The extraction site was augmented for ridge preservation, and graft material with a Gore-Tex augmentation material membrane was used to expand the osseous volume of bone.



**FIGURES 4E AND F.** Six months later, the ridge has been augmented with good radiographic bone density.



**FIGURES F.**

restoration. If this distance is greater than 4.5 mm, the patient needs to be aware that prosthetic compromise may be needed to close the interproximal space.

The shape and position of the hopeless tooth also need to be evaluated in the diagnostic assessment for immediate implant placement. Square-shaped teeth

may have a more favorable esthetic outcome than ovoid or triangular-shaped teeth because the interproximal contact is longer and more tooth structure fills the interdental space (Figures 3a and b).<sup>15</sup> There is less risk of interproximal recession with this shape tooth than there is with a tooth with a triangular/taper shape,

where the interproximal contact area is positioned incisally and more tissue height is needed to fill the interproximal area. Even the slightest amount of tissue loss may create interproximal black triangles.

Labial alveolar bone and the overlying soft tissue is often thin when teeth are positioned too far facially. Extraction

and immediate implant placement may result in perforation, or extensive loss of the labial bone and the collapse of the gingival architecture. In this case, ridge augmentation and preservation procedures prior to implant placement may result in a more favorable esthetic outcome (Figures 4a through f). On the other hand, lingual tooth position often results in thicker labial bone and gingival tissue. A hopeless tooth in this position is more favorable for immediate implant placement due to less likelihood of damage during extraction and implant placement. In addition, soft-tissue loss may be minimized, and there would be less chance of a gingival discrepancy in the final restoration.

## Conclusion

Accurate diagnosis and treatment planning are essential in achieving optimal implant esthetics. Immediate implant placement following extraction of a hopeless tooth can often result in ideal functional and esthetic results if specific diagnostic criteria are evaluated and the appropriate treatment rendered. Too often, results are compromised because of failure to accurately assess the multiple factors involved with extraction and immediate implant placement in the esthetic zone. The restorative team must have a thorough understanding of the osseous and soft-tissue profiles associated with a failing tooth to decide if immediate implant placement will achieve the desired esthetic result. In situations where immediate implant placement is not possible, ridge preservation needs to be performed to minimize tissue loss. This will minimize the corrective augmentation procedures necessary to obtain an esthetic result with delayed implant placement. Delayed placement, unfortunately, requires more surgical effort, time, and expense to achieve an acceptable esthetic result. Whenever possible, the restorative dentist should consider collaborating with the surgeon in evaluating if an immediate implant can be placed. This would provide the optimal esthetic end result.

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# Prerestorative Considerations for Cosmetic Dentistry

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**ABSTRACT** Helping patients improve their appearance with esthetic procedures can be very rewarding. Optimal esthetic results often require a multidisciplinary approach and sequenced care. Treatment planning with a team approach offers the potential for multiple perspectives and the best opportunity to achieve the optimal results.

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Cosmetic dentistry has become an important part of many dentists' practices. In this era of emphasis on fitness and personal appearance, baby boomers have reached an age where they have the discretionary income and desire to consider procedures to improve their appearance. Additionally, the availability of information through the media has made the public highly aware of and educated about esthetic dentistry. The general dentist is receiving more inquiries regarding cosmetic dentistry and those inquiries are leading to an increase in demands for cosmetic and adjunctive procedures.

Dental school curricula provide only an adequate background in the fundamentals of cosmetic materials, diagnostic analysis, and techniques. To further improve these skills, general practitioners need to consider taking continuing education courses, with an emphasis on extensive hands-on courses. Unfortunately, most

courses do not focus adequately on the concept of the team approach to providing cosmetic dentistry. Optimal success in cosmetic dentistry comes not from individual effort, but from a collaborative team effort.<sup>1</sup> The general dentist must function as the team leader, coordinating the diagnosis, treatment planning, and treatment progress among all members of the team. These members may include any or all of the following: laboratory technician, periodontist, oral surgeon, orthodontist, and endodontist.

Prior to defining which members of the team are needed for a case, it is essential for the cosmetic dentist to gather the necessary baseline information. This includes:

- Full-mouth diagnostic radiographs;
- Pretreatment photo documentation;
- Mounted study cast; and
- Smile analysis incorporating the occlusion, gingival, and orofacial supporting tissue.

Once the baseline information has



**FIGURE 1.** A bite-stick registration is taken to help orient midline and bite plane during the model mounting process.



**FIGURE 2A.** Crowded anterior teeth with heavy staining and darkening due to root canal.



**FIGURE 2B.** Ten crowns realigning the anterior teeth for a pleasing smile.



**FIGURE 3A.** Diagnostic wax-ups are useful in analyzing cosmetic issues and for case presentation. A patient with peg lateral incisors and slight midline shift wishes to improve his appearance.



**FIGURE 3B.** A diagnostic wax-up was useful in defining the new midline as well as the relative tooth proportion and form. The wax-up was useful in providing the patient with a visual aid of the end product.



**FIGURE 3C.** The completed case.

been gathered, a preliminary decision can be made as to the team members needed for the case. The cosmetic dentist must orient the patient as to why other members are being included on the treatment team. Referrals are then made. The baseline information will often be useful in providing valuable insights for team members as well as avoiding duplication of services. After the consultations, the cosmetic dentist will coordinate the findings and develop a consensus treatment plan. This paper will review the necessary baseline information and collaborative efforts that are often necessary when providing cosmetic dental procedures.

### Radiographic and Photo Documentation

The first step for a proper diagnosis is the collection of radiographic and photographic records.

A full-mouth radiographic series of diagnostic quality is essential for the evaluation of caries, periodontal disease, and oral pathology. In cosmetic dentistry, information such as root length, interproximal bone height, and crown-to-root ratio are important in the event gingival reshaping is indicated. Signs of periodontal disease such as infrabony and osseous defects should also be noted.

Photo documentation is important in helping the treatment team evaluate the patient's smile characteristics.<sup>2</sup> High-resolution digital photos or 35 mm slides permit magnification of images, which often reveals subtle details difficult to discern clinically. Not only can the images of the smile be scrutinized, but they can also easily convey valuable information to other members of the team. **FIGURE 1** is an example of a patient that communicates the midline and incisal edge relationship to the laboratory technician. Photographs

also give a realistic sense of color and texture of the teeth and surrounding soft tissue. These baseline photographic series are also useful for comparative purpose. Upon completion of the case, the "before" and "after" are useful to help the patient appreciate the esthetic transformation they have undergone (**FIGURE 2**). These photographs are also helpful for self-critique and patient education.

### Diagnostic Casts Models

Pretreatment diagnostic casts are important for diagnostic evaluation and as a legal part of the patient record. Study casts should be mounted using a face bow and appropriate bite registration record. The casts are then duplicated for diagnostic wax-up. If bleaching of the teeth is planned, a third set is useful for the fabrication of bleaching trays.

The diagnostic wax-up is an important aspect of treatment planning.<sup>3-5</sup> With





**FIGURE 4A.** Large discolored composites with disproportional anterior teeth.



**FIGURE 4B.** Anterior temporaries, which are the template for the final restorations.



**FIGURE 4C.** The final restorations mimic the temporaries.

the wax-up, tooth shape, incisal edge position, relative tooth proportions and angulations, contact points, embrasures, midline, and the gingival architecture can be analyzed (**FIGURE 3**). The starting points of the diagnostic wax-up should be the midline.<sup>6</sup> Whenever possible, the midline should be parallel and as close as possible to the midline of the face. A midline canted one way or the other is often the cause of failure in cosmetic cases. The diagnostic wax-up will not only help the clinician identify position, spatial, and angulation problems, but it is also useful in providing the patient with an image of the final product.

### Initial Smile Analysis

The initial phase of the smile analysis begins with the laboratory technician using the collected data to create a diagnostic wax-up. This is the process of determining the tooth shape and position that best complements the patient's facial characteristics. Patients who seek cosmetic dentistry are people who want to look younger and feel better about their smiles. A youthful smile is characterized by a bright white smile that shows plenty of tooth structure and provides adequate lip support. In a smile analysis, the central incisors are the focal point of design, and canines are the cornerstones to the buccal corridor. In discussing the creation of ideal central incisors, most dental literature refer to the golden proportions, which means that if one assigns a value of the width of

the lateral as 1.0, the width of the central is 1.6 times the width of the lateral. The width of the mesial one-third of the cuspid is 0.6 times the width of the lateral. The length-to-width ratio is 80 percent. Most technicians use this rule as a guide but not as an absolute.

The second phase of the smile analysis is to check the wax-up with the patient present to see if the shape, length, and width of the wax-up will complement the patient's facial features. This is a critical point in deciding if other adjunctive procedures, such as crown lengthening, may be needed. A splint fabricated from the diagnostic wax-up can be transferred to the mouth to help the patient visualize the final result.

The most important stage of the smile analysis is to evaluate the smile with the provisionals on the prepared teeth (**FIGURE 4**). The provisionals should duplicate the final diagnostic wax-up. Both the patient and clinician should assess the esthetics. The clinician should also check functional requirements such as phonetics, lip support, and occlusion. The height and symmetry of the gingival crest is evaluated in the context of the patient's smile line. If adjustments are needed, the temporaries can be shortened in the mouth or lengthened by adding a flowable composite. It is vital that the patient is pleased with the shape and contour of the temporaries because they will serve as a template for the final restoration. Once everybody is happy, an alginate impression

is sent to the lab.

### Selecting the Team Members

#### Laboratory Technician

The laboratory technician is an important, yet often overlooked, member of the team. The lab technician utilizes the study models and photographs to develop various smile designs on the model. The technician's job is to define the individual smile design. This is done by managing the embrasure spaces, line angles, and incisal edges of the diagnostic wax-up such that it is characteristic of a youthful smile. Embrasures get larger in the posterior direction. For many patients, tooth symmetry is critical. Upon completion, the diagnostic wax-up is jointly reviewed by the clinician and patient prior to the preparation date. The technician also helps in the fabrication of the template for provisionals. The provisionals should reflect what is present on the patient-approved diagnostic wax-up. The delivery of the provisionals permits a final evaluation prior to the definitive restorations. The technician's efforts are critical to fabrication of the final restorations and the potential for treatment success. Regardless of the other team members' efforts, if the porcelain is not of the highest quality, the case will fail; and ultimately, the general dentist will be blamed. Communication between the dentist and the technician is vital for the success of many cosmetic procedures.

### Periodontist

The periodontist can contribute to case management through the development of ideal soft tissue-teeth relationship. With current techniques in cosmetic periodontal plastic surgery, the periodontist is capable of moving gingival tissue apically through crown lengthening or gingivectomy. Coronal positioning of the soft tissue can be done with the shifting or augmentation of gingival tissue. Soft tissue and ridge deficiency can be treated by various hard- and soft-tissue grafts. Ridge preservation procedures can also be valuable to prevent tissue collapse around extraction sites.

### Oral Surgeon

The oral surgeon is included on the cosmetic team to help with skeletal problems that may be encountered. It is quite difficult to create an enhanced smile design on someone with a severe class 2 or class 3 malocclusion. The correction of a skeletal malocclusion may include orthognathic surgical treatment. The oral surgeon can perform various combinations of LeFort procedures, mandibular advancement/retraction, and chin augmentation/reduction. The goal of these procedures is to develop appropriate skeletal and soft-tissue support for the esthetic smile. If extractions are needed, it is important that the surgeon is aware of the dentist's goals for ridge preservation and maintenance of gingival contours.

### Orthodontist

The orthodontist's contribution to the esthetic team effort is often in tooth positioning and site preparation. Teeth may be aligned in the ideal position for the final restoration. During the orthodontic treatment, it is also important that the teeth be intruded/extruded so that the gingival crests are in an ideal relationship to each other as well as the surrounding soft tissue, notably the lips. Orthodontic treatment is both costly and time-demanding. This may at times deter patients from this treatment modality.

Alternatively, there is "instant

orthodontics,"<sup>7</sup> the correction of dental misalignment through the use of veneers and crowns. This treatment may be aggressive and at times require therapeutic endodontic treatment. For correction of gingival contours, crown lengthening, or gingival augmentation, a periodontist may be needed. This is a viable alternative for patients who are not willing to trade the time for the conservative management of their malocclusion.

### Endodontist

When cosmetic procedures are involved, it is particularly undesirable to have a tooth that is stained or highly discolored. The presence of metallic posts and long-term pulpal necrosis are situations in which discoloration occurs. The dark base color makes it difficult to obtain the translucency and vitality the dentist and patient are looking for. The endodontist is often included as a member of the cosmetic dental team because of the potential for these problems. In teeth that have large metallic posts and buildups, 8-11 the root surfaces have a dark color due to the reflection of the post through the root surface. Often, the post can be removed atraumatically under a microscope and be replaced with a porcelain or fiber post. This allows a lighter color to shine through the root and makes it easier to mask any discoloration. Similarly, discolored teeth can be treated with root canal therapy and be internally bleached.

At times, all disciplines of dentistry need to be called on to obtain the optimal results. Being an elective procedure, cosmetic dentistry requires precision and superior esthetics by an often demanding patient. It is the cosmetic dentist's responsibility to coordinate and lead the team toward this goal.

### Clinical Cases

The following are three clinical cases that demonstrate how optimal esthetic results can be obtained through an interdisciplinary approach.

### Case 1

A 16-year-old boy was seen on an emergency basis with his chief complaint being a fractured front tooth, incurred during an inline skating accident (**FIGURE 5a**). On examination, it was observed that tooth #9 had a mesio-incisal fracture that ended at the crestal bone. A pulpectomy was done to relieve the patient's pain and to give the team members enough time to review the case.

Due to the patient's young age, the team decided to try to save the tooth with root canal therapy. Due to the lack of tooth structure for retention, crown lengthening was performed via orthodontic extrusion. Performing a conventional crown lengthening procedure with periodontal surgery was rejected because it would cause differences between the height of the gingival crests of the two central incisors. The advantage of orthodontic extrusion in this case was that the gingival crest of tooth #9 was relatively more apical than that of #8. With extrusion, the osseous- gingival complex was coronally positioned. Crown lengthening can be performed at the end of orthodontic treatment to even the gingival crests. Operationally, the extrusion procedure was preceded with a temporary composite build-up to permit bracket attachment.

After approximately one year, enough tooth structure was present to proceed with crown restoration. The tooth was prepared for a ceramic core and an impression was taken and sent to the lab. A temporary post and crown was fabricated, and the patient was sent home. One week later, the ceramic core (**FIGURE 5b**) was bonded into the canal with resin bonding cement base and catalyst, along with bonding agent using a rubber dam. After the preparation was refined, another impression was taken for the all-ceramic crown, and a custom shade was taken with the help of the lab technician. When the patient returned 10 days later, the all-ceramic crown was bonded on with translucent shade resin bonding cement using bonding agent and a rubber dam.



**FIGURE 5A.** Tooth #9 has a mesial fracture to the crestal bone.



**FIGURE 5B.** Tooth placement of post.



**FIGURE 5C.** Postoperative picture of the bonded crown.

A multidisciplinary approach to this case enabled the team to save the tooth and avoid an implant or bridge. The endodontist can critically evaluate the extent of the fracture and whether the tooth can be saved, and the periodontist and orthodontist can evaluate the best way to perform crown lengthening without compromising esthetics. This team approach provided the most esthetic and predictable result for the patient. (**FIGURE 5C**).

### Case II

Short clinical crowns and excessive gingival display are a frequently occurring cosmetic problem. Clinicians must determine the cause of the shortness to determine the best course of action for the patient. The following two cases give different approaches to achieving this goal.

A 40-year-old female presented with her chief complaint being “my teeth are short and dark, and I hate the big space between my front two teeth” (**FIGURE 6a**). The clinical exam revealed a gummy smile with tetracycline-stained teeth. Additionally, there was a large diastema, which a previous dentist had tried to close with a direct bonding procedure. The papilla between tooth #8 and #9 was non-existent due to the high attachment of the thick fibrous frenum.

Phonetics plays a major role in any cosmetic work-up, and the location of the incisal edges of anterior teeth is crucial for achieving proper sounds. To find the right length of her anterior teeth, the

practitioner asked the patient to recite several words with the letter “F” (fifty-five, firehouse, etc.). The patient’s upper anterior teeth slightly contacted her lower lip, showing that her incisal length was correct. Once this was known, it could be determined that to achieve more tooth in her smile, the team would have to address the gingival counters. Using this information and comparing the anatomical length of the anterior teeth to the clinical crowns using X-rays, it was determined that the cemento-enamel junctions of the teeth were quite subgingival. This problem could be corrected one of two ways: either by orthodontics or periodontal crown lengthening. The patient chose crown lengthening to shorten treatment time.

Study casts with the ideal tooth length were waxed up. The diagnostic wax-up also attempted to shift the gingival crest of the anterior teeth toward the midline. This would in effect close the diastema without having the two central incisors appear disproportionately wide in relationship to other anterior teeth. Once the patient approved the diagnostic setup, a vacuum splint was made to serve as a surgical guide for the periodontist. This guide is useful in defining the final gingival margin and how the gingival crest will be positioned. The splint ensured adequate osseous contouring is performed so the margins of the final case would not infringe on the biological zone of attached tissue. If there is not at least 2 mm between the osseous crest and the restorative margin, the gingival tissue will always appear

inflamed, or the tissue may remodel such that the gingival margins become exposed. In addition to the crown lengthening procedure, frenectomy and papilla augmentation with a connective tissue graft was performed to give adequate bulk of gingival tissue to eliminate a midline “black triangle” space problem.

After approximately six weeks, a new set of models was taken. Working with the help of the lab technician and preliminary photos, the team decided to wax up the eight anterior teeth to achieve the correct tooth proportions. Prepping posterior to the canines allowed the lab technician to steal some space from the distal of the canines and the premolars, making the smile more proportional. If, for example, only the front six teeth had been prepared, the patient would have been left with enormously wide teeth. During the preparation, great care was taken to remove as little as possible from the mesial of the central incisors, while keeping in mind that the team wanted to sink the mesial margins subgingivally. This allowed the technician to pinch the tissue and helped close the diastema.

The success of the treatment approach is evaluated by temporaries, which act as templates. They can be adjusted to help attain the desired affect and then transferred to the lab via an alginate impression. The restoration we made out of all-ceramic porcelain crowns (**FIGURE 6b**).

The key to success on this case was the effective use of a diagnostic wax-up and casts. A surgical stent helped guide the



**FIGURE 6A.** Tetracycline-stained teeth with large composite bonding. The triangular space is residual space after the attempt to close the diastema with bonding. Note that the central incisors are disproportionately wide in relationship to the rest of the anterior teeth.



**FIGURE 6B.** Placement of eight crowns after crown lengthening and connective tissue graft.



**FIGURE 7A.** Discolored composites with tetracycline staining and bilateral anterior open bite.



**FIGURE 7B.** Crown lengthening procedure performed toward the end of orthodontic treatment to expedite the development of appropriate gingival architecture.



**FIGURE 7C.** Eight veneers creating a proportional and pleasing smile.

periodontist at the time of surgery. The surgeon can determine where the apex of the gingival crest will be located by knowing the tooth size and position. The shifting of the teeth toward the midline to help close the diastema would have been very difficult to determine without a surgical guide. This case also demonstrates the advances that have been achieved in esthetic periodontal surgery. Soft-tissue deficiencies can also be corrected with soft-tissue grafts, and the gingiva can be positioned coronally with semilunar or connective tissue graft procedures.

### Case III

A 30-year-old woman presented with the following chief complaint: "I would like to replace my old bondings so I can have longer, whiter teeth." A clinical exam revealed a class 1 malocclusion with a 2 mm overjet, 10 percent overbite, and a bilateral

open bite. The teeth were short and stained by tetracycline (**FIGURE 7A**). The marginal gingiva was inflamed, it was believed, because the patient was a mouth breather. It was determined that the anterior teeth had not fully erupted. The patient chose to start orthodontic treatment rather than a full-mouth rehabilitation and periodontal crown lengthening.

The orthodontic treatment took almost one year to be completed; but, toward the end of treatment, a new challenge arose: The patient was getting married. The patient insisted on finishing the treatment as soon as possible. This changed treatment because the orthodontist did not have enough time to line up the gingival architecture. The patient was sent to the periodontist while in braces to finish elongating the teeth with crown lengthening (**FIGURE 7b**). After surgery, the orthodontist gave the case its final touches,

and the patient was then sent to get prepared for eight anterior veneers.

It was paramount that the temporaries be closely watched to make sure the patient was comfortable with the new bite and elongated teeth. After the dentist and patient were satisfied, the results were transferred to the lab. Ceramic veneers were used to hide the tetracycline stains. The final restorations were bonded using a rubber dam and the resin bonding cement system (**FIGURE 7c**).

### Summary

Esthetic dentistry is an art. In mastering this art, the clinician must think about strategies to ensure the optimal esthetic results. Mastery involves learning to collect baseline information, assembling a multidisciplinary treatment team, and coordinating the various diagnostic and treatment modalities. Though some of



this strategy is introduced to during dental education, dentists need to hone these skills with additional training. As practitioners learn to develop these skills, their ability to provide the best cosmetic result possible will improve.

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# Bench-Pressing 500 mg

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What weighs close to 50 pounds, is full of pills and contains enough scientific facts to make your eyes bleed? It is the Physicians' Desk Reference, of course, a publication so dedicated to the skinny on pills, capsules, elixirs and ointments that the publishers have to issue a new edition every year just to keep abreast of a pharmaceutical industry gone mad.

Within the 3,000 pages of this medical marvel are descriptions of a gazillion different pills -- so many pills that every man, woman and child in the nation could have a handful and nobody's would be the same. We are a pill-popping nation, and at last comes an account of a new pill that all of us except a tiny little minority of fitness nuts have been waiting for since Lydia Pinkam's Compound (Pink Pills for Pale Ladies) was introduced in the 1800s.

Background: At Gold's Gym in Dallas, over on the Nautilus machines, is a group of mice all decked out in Adidas sweat gear and New Balance cross-training shoes. They are exercising up a storm, and it is evident by their six-pack abs, awesome gluts and developed delts that the strenuous workout is paying off. Over in the spa area is another group of mice, wearing cut-offs and T-shirts with University of Texas Southwestern Medical Center emblazoned across their impressive pecs. Their activity is limited to lying in hammocks, sipping Gatorade

and ogling the current swimsuit issue of Sports Illustrated. What strikes the on-lookers as odd is that the second group of rodents is just as fit as the sweat-intensive first group, if not more so; and not one of them is lifting a paw. No crunches, no stair-steps, no bench pressing -- nothing. These recumbent rodents are the result of experiments being conducted by one Dr. R. Sanders Williams, dean of the Duke University School of Medicine and his colleagues.

In collaboration with his team, Dr. Williams, whose parents have never publicly explained why they named him Sanders, has come up with an idea for yet another pill. The journal Science claims it will knock the socks off all those Baby Boomers who are beginning to notice spare tires, saggy underarms and the terrible effects of gravity on their middle-aged spreads. If Williams et al. are right, you can forget those zillion and one offerings in the PDR, this pill is the only one you'll ever want.

All right already, you ask, what kind of a pill is it? It's a pill that pumps up muscles WITHOUT exercise. It's a pill that will let people get the health benefits of regular exercise even if they never stir their stumps. Impossible, you scoff? Well, suppose we let the mice explain it.

**Spa mouse:** Until recently, our primary mouse activity was frightening women

into jumping atop chairs and screaming, “A mouse! A mouse!” Occasionally some hyper gal would go after us with a broom. It was the only exercise we ever got. Me and some of the guys were chosen one day to have our genes altered so that they produced a surplus of CaMK, or calmodulin-dependent protein kinase.

**Gym mouse:** If there’s a point to this, would you get to it!

**Spa mouse:** The point is, when this protein is activated, it triggers the physical changes that muscle cells undergo after intense exercise. That means, Rambo, that with high levels of CaMK in us, we develop the same healthy muscle cells sitting around watching the clouds form as you guys do busting your buns on the weight machines.

**Gym mouse:** It also means that pharmaceutical companies have yet to figure out how to make this so-called exercise pill and have it retail for less than 5 bucks a pop. Back to the treadmill!

Nevertheless, Dr. Williams is optimistic. He says the main target of the research is to promote the health of people with heart disease or other conditions that keep them from doing enough exercise. Right on, echoes Dr. Keshav Singh of John Hopkins University School of Medicine. “Since levels of mitochondrial proteins decrease with normal aging, this study may also help develop therapies

to increase the physical endurance in the aged.”

If so, Doctors, you’d better get the hell out of the way as the hordes of smelly, sweating gymrats rush to buy that pill so they won’t have to sustain that “no pain, no gain” bull any longer.