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CDA

Dr. Clifton O. Dummett
Standard Precautions

JOURNAL OF THE CALIFORNIA DENTAL ASSOCIATION VOL.31 NO.4
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The Progression of Prosthodontics

PARTIAL DENTURE
GOLD CROWN
PORCELAIN JACKET CROWN
POST AND CORE
METAL CERAMIC CROWN
PORCELAIN CAP
PERIODONTAL PROSTHESIS
CERAMCO BRIDGE

IMPLANTS
IMPLANT CROWNS
IMPLANT SUPPORTED
COMPLETE DENTURE
IMPLANT FIXED
PARTIAL DENTURE
REMOVABLE PARTIAL DENTURE
CAD/CAM
PROCERA IMPLANT BRIDGE
ZIRCONIUM CROWNS
ALUMINUM OXIDE CROWNS
IMMEDIATE LOADING

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DEPARTMENTS

291 *The Editor/Unrealistic Expectations -- Dentistry's Demon!*
295 *Profile/Clifton Orrin Dummett, Sr. -- Content of Character*
299 *Impressions/Understanding Personality Types Can Enhance Working Relationships*
362 *Dr. Bob/Anxiety Management*

FEATURES

311 PROSTHODONTIC TREATMENT PLANNING: CURRENT PRACTICE, PRINCIPLES, AND TECHNIQUES
Roy T. Yanase, DDS

315 AK PATIENT PRESENTATION
Robert G. Tupac, DDS

321 PERIO-PROSTHETIC TREATMENT PLANNING IN IMPLANT DENTISTRY
Marc Alexander, DDS

323 TREATMENT PLANNING FOR THE FUTURE: ENDODONTICS, POST AND CORE, AND PERIODONTAL SURGERY -- OR AN IMPLANT?
George S. Matosian DDS

326 TREATMENT PLANNING CONSIDERATIONS: QUESTIONABLE TEETH OR IMPLANTS
Harel Simon, DMD

329 TREATMENT CONSIDERATIONS OF FIXED PROSTHETIC RESTORATIONS OF THE COMPROMISED DENTITION VS. ALTERNATE FIXED IMPLANT-SUPPORTED OPTIONS
Peter F. Johnson, DMD

333 IMPLANT-RETAINED REMOVABLE PROSTHETIC DESIGNS FOR PATIENTS WITH MAXILLARY POSTERIOR EDENTULISM
Steven J. Sadowsky, DDS

337 THE EVOLUTION OF IMPLANT THERAPY FOR THE EDENTULOUS PATIENT
Frank M.A. Vidjak, DDS, MSEd

339 WHAT CAN WE OFFER PATIENTS WITH TODAY'S ADVANCEMENTS IN DENTAL MATERIALS?
Christopher B. Marchack, DDS

343 THE EVOLUTION OF STANDARD PRECAUTIONS
John A. Molinari, PhD

CDA JOURNAL, VOL 31, Nº4

Unrealistic Expectations -- Dentistry's Demon!

Jack F. Conley, DDS

In a previous column, we commented on the negative role that miscommunication and misinformation in word or print can often play in shaping members' attitudes about the value of their association membership. We offered the view that poorly informed opinions advanced by those perceived to have expertise based upon professional experience, by those in leadership positions, or by so-called outside "experts" can often lead uninformed colleagues to the negative conclusion that membership in organized dentistry is of questionable value.

The perceived level of success that the association has had in dealing with major outside entities that seek to modify dentistry also influences formation of these negative conclusions. If the association is successful in its pursuit of issues of professional concern, the critics (aka "experts") are quiet; and the satisfaction level with organized dentistry is positive. If a decision or compromise reached on an external issue of importance to dentistry does not meet the "expectations" of the critics, their opinions on the shortcomings of their organized profession, whether justified or not, enter into the discussions that occur at dental society meetings, study clubs, and other professional gatherings. Instead of questioning the fitness of the organization itself, the question all critics should really ask is, "Were our expectations for a preferred or desired decision in dealing with external intrusions' REALISTIC?"

Too often, in a rapidly changing world, we have felt that the expectations held by many of our colleagues for organized dentistry to negotiate an outcome that either favors the status quo, or is more favorable to the profession than to the public, are UNREALISTIC. In fact, some issues with public importance may leave no room for any negotiation.

Our concern goes well beyond whether a dentist's position on an issue is reasonable. We believe that two characteristics of members of our profession prevent many colleagues from accepting or supporting any decision that compromises what they desire.

The first is that most of us do not respond well to change. We become entrenched with our business, continuing to do the things we were taught or learned early in our careers because they have enabled us to achieve various goals along the way. While some in our profession do constantly look for new methods and materials, many of us are content to continue using the methods, principles, and techniques that have brought satisfaction and success. Most important, we are reluctant, or even unhappy, if an outside entity seeks to change, or is successful in changing, policies or procedures that force us to modify our work patterns in practice. This is not a criticism but rather a trait that has traditionally characterized the dental practitioner. Dentists are not alone, as this characteristic is probably typical of many small-business owners. OSHA requirements, the Dental Materials Fact Sheet, HIPAA, the Denti-Cal fee schedule, and the Proposition 65 negotiations and settlement are some of the major dissatisfiers that have faced dentists in recent years.

The second characteristic many dentists share is that, either by nature or as a result of the philosophy under which we were trained, we seek perfection. Many achieve that reputation from patients and other colleagues. This being the case, it should not be a surprise that an individual expecting perfection and success within his or her own enterprise would find a lack of success by their representatives in achieving the result they personally want to be below their expected standard.

To bring this discussion full circle, a group that seeks perfection and dislikes change expects these principles to be upheld by those representing their interests in the public sector. This is why dentistry's representatives are frequently in a "no-win" situation in the regulatory-happy business environment today, because they will automatically receive some blame from within the membership for failure to achieve a "perfect" resolution or maintain the status quo. Those expectations however, are UNREALISTIC. Such unrealistic expectations end up being divisive if they are used improperly to sway some members and nonmembers into believing that membership in organized dentistry does not provide desired value.

The unrealistic expectations that many dentists have for their membership organization explains why some fail to join or to remain as members. Through education, it is our hope that more colleagues will understand the negative impact that Dentistry's Demon of unrealistic expectations has upon our collective strength as a profession.

Brief Anatomy of a Negotiation

By now, all CDA members should have had the opportunity to review the settlement package of the Proposition 65 case. In a world of perfectionists, the require-

ments this settlement brings are not popular. We are printing here a letter written by Linda Seifert, general counsel of the California Dental Association, that we believe does an excellent job of describing some of the issues and obstacles of the Proposition 65 negotiations and settlement that lasted almost two years.

This letter was originally addressed to some CDA members who had raised concerns and questions about the Proposition 65 settlement and the new requirements it will impose on dental offices. Those reading this letter should realize that an expectation for a better final outcome would have been unrealistic. Association efforts not only supported those CDA members out of the group of 80 who had been served with Notices of Violation, but also supported every dentist who could have ultimately been served with a notice in the future, had CDA not stepped in.

***

Dear Member,

Your letter concerning the Proposition 65 settlement has been forwarded to my attention for response. As you know, settlement of any litigation requires negotiation and compromise. In a perfect world, CDA would have preferred that dentists not be required to issue warnings under Proposition 65 and that the chemicals that are used in the dental office not be included among those for which the state of California requires a warning. Unfortunately, those positions were not available to us, and I continue to believe that CDA's leaders made the best of a most difficult situation.

Before my tenure with CDA, CDA was a party to litigation in which we argued that FDA rules pre-empted the state law and that, under federal law, dentists could not be required to comply with Proposition 65. After many years of litigation, the court in that case mandated that dentists comply with the warning requirements. Since before the final rulings in that case, CDA has advised its members to post warnings and has disseminated warning signs that focused on amalgam.

When 80 dentists in California were served with official Notices of Violation in early 2001, the attorney serving the notices warned us that his plan was to shortly serve more and more dentists throughout the state. At that time, CDA made a calculated decision to seek resolution of this matter on behalf of the entire profession. We then re-evaluated whether there were legal challenges that could be made, consulted with other industries and associations that had challenged the law, met with several lawyers expert in this field, and concluded that further legal challenges would not achieve a favorable result. As you are likely aware, the plaintiff group that brought these actions was most interested in forcing a warning about mercury, one of the chemicals on the state's list. In evaluating our position, we concluded early that we would not be able to eliminate a warning for this chemical for numerous reasons. In the absence of litigation as a viable alternative, our goal became to achieve a resolution that would achieve compliance for members and reasonably ensure that no further Proposition 65 violations could be assessed against our members so long as they posted the approved sign.

The negotiations leading to the signage that was included in the recent article that was sent to you as part of the court-ordered settlement package occurred over approximately two years. When the agreed-upon signage was submitted for the court's approval in late December 2002, the judge refused to approve the proposed language and eventually (with comment and recommendations from both sides) drafted language of his own that he maintains will provide consumers with the information required by the law. While the signage is not completely to our liking, we were satisfied with it as it informs patients that the U.S. Food and Drug Administration has approved all dental materials for use. All in all, we were "pleased" with the result.

As to what you should advise your patients when they inquire about the "Notice," we have developed a "Frequently Asked Questions" document for both patients and dentists that is included on the CDA Web site (www.cda.org).

Linda Seifert
General Counsel
California Dental Association

CDA JOURNAL, VOL 31, Nº4

Clifton Orrin Dummett, Sr. — Content of Character

Michael M. Okuji, DDS, MPH, MBA

"Doctor Dooo-Mitt ...," Meharry's President M. Don Clawson has difficulty in pronouncing the name correctly and persistently repeats the error. Dean Clifton O. Dummett, not yet 30 years old, stands to address the assembled dental and medical faculty. Dummett wears a tailored suit -- he's never pictured in shirtsleeves -- a white pocket square, a swirl of linen worn with the same panache and flair with which he wields a pen; and a signature bow tie. His eyes have a focus that is often mistaken for a sign of disapproval. "Since I respectfully disagree on principle with my president, I hereby tender my resignation as dean of Meharry Dental School, effective immediately." So ends the tenure of the youngest dean ever appointed to an American dental school.

On this hot and humid Nashville afternoon, Clawson gives his full support to the Southern Regional Plan. The plan provides desperately needed financial support to Meharry Medical College and its Dental School but would designate Meharry a regional school to educate exclusively the Negro population of the Southern states. The plan is promulgated by the governors of 11 Southern states to maintain institutional segregation in all Southern professional schools.1

It is clear to Dummett that the doctrine of separate but equal even with the emoluments of financial salvation is to be opposed. He concludes that no additional Southern segregated dental schools should be constructed. He insists that Meharry and his colleagues join the mainstream of professional education at the highest levels. It is June 1949 in the Jim Crow South. It is five years before Brown v. Board of Education. It is 14 years before a Southern governor stands in the schoolhouse door on a principle. Dummett makes his stand on a different principle.

On this June afternoon, in this Nashville auditorium, he is a solitary voice against separate but equal. He must resign on a principle. A principle that with the passage of time will prove to be right. His stance on principle is far from popular with his colleagues. "My basic philosophy regarding regional schools ... my adverse opinions of racially separate regional schools are contrary to general opinion."2

Why did he walk away from the opportunity of a lifetime? What about the financial security of his young wife, Lois, and baby boy, Clifton, Jr.? Where was his contingency back-up job? W. Montague Cobb of Howard University writes that this was "the first time in my recollection that a Negro in a position comparable to yours has resigned his job on a matter of principle"3

He did so because expediency is not Dummett's forte. In 1949, the secretary of the American Dental Association's Council on Dental Education rebuked Dummett by writing that "in pursuit of your ideal ... you overlook reality and stand practically against the present needs of your people ... In this matter, you are an idealist and I am a realist."4 For idealist, read dreamer.

Idealist? Dreamer? Rather, Dummett is a visionary; a man willing to bear rebuke, remonstration, and rejection. If you will, one of the great men of our era. Great? One might say that he lost more battles than he won. But, a look across the decades shows that he really did not lose battles. He has mounted sieges that continue today. Where there are no doors to break down, he has breached walls. It is not his voluminous accomplishments but his character that makes him great.

To many students and faculty today, he remains a familiar but opaque figure, an eminence grise. They recognize him but don't know him. Yet, aspects of his character are all around us.

Just as Dummett was the sole administrator at Meharry who was a publicly outspoken critic of segregated regionalization,5 he was equally outspoken for the abolition of segregated professional associations. While physicians and nurses freely admitted Negroes to their associations, many southern American Dental Association constituent societies were most adamant in their collective opposition to accepting Negro dentists and did

everything in their power to prevent, forestall, and discourage membership. The system of attaining full ADA membership was easily manipulated by any group desirous of discriminatory practice. And with equal candor, Dummett countenanced dismantling the National Dental Association and melding its members into a greater society of healers and scientists.6 Separate but equal in any form is anathema to him.

His view on the need for greater opportunities for Negroes in dentistry and its solution was prescient and is probably just as unpopular today in some quarters. In 1947, there were 313 Negro dental students, most of them at Howard University and Meharry. In 1948, he pointed out the urgent need for immediate action to increase the numbers of qualified Negro applicants for admission to all U.S. dental schools and to expand their opportunities at all levels of dental education.7 Fifty-two years later, in the first year of the new millennium, the total African American dental student enrollment is 832.8

But, Dummett is not an apologist for baseless preferences or shoddy work. "I have examined the applications of past, present, and prospective students at one of the two Negro dental schools; and it is my opinion that too large a number of the applicants had received inferior preparatory work. ... It is hardly to be advocated that such students be admitted on an educational basis different from that of other, better-qualified students. ... The solution to this problem would be to improve the preparatory training of the Negro students so that they would be able to compete scholastically with all other students."9 And in 2002, the American Dental Education Association's 5th Minority Recruitment and Retention Conferences convened to address the same issue.

Dummett's view on the health of the people is no less visionary and tinged with controversy. "Despite common stereotypes, America's poor come in all colors, shapes, sizes, ages, origins, backgrounds, religions, and ethnicity. Their health needs are similar. Understanding the predicaments of the powerless poor is prerequisite to caring for their needs."10 And in 2002, we have the $11 million Center to Address Disparities in Children's Oral Health at the University of California, San Francisco.

As for the inclusiveness of access to health care for all the peoples of the world, Dummett writes, "There is an additional aspect to this NDA (African) Program for which this writer has been praying, and this is the inclusion of other countries and nationalities in the NDA Program of help. There are millions that need dental help in (other parts of the world), as well as the African states. The concern then must be for all suffering humanity."11

During his long siege breaching walls to bring his vision to reality, Dummett has endured disappointment and rejection.12 Yet he has not become bitter. Slights and slurs don't mark his visage. In fact, he's quite magnanimous to his critics and foes in the many biographical pieces he has written.13 He observes, "Cynical indeed are those in whose hearts are not stirred great expectations for eventual and ultimate realization of every good for which democracy and America stand."14

However, never mistake his patrician demeanor and good nature for weakness. "Humility is not sycophancy. It does not embrace the toadying, groveling servility upon which intimidation and bullying thrive. True humility requires much intelligence and courage -- intelligence to distinguish what it is from what it is not; courage to foster what it is, to despise what it is not. The eventual goal of integration must be approached from many angles. Human relationships are involved so that there is no single answer or solitary method of achieving this goal. An attitude of gracious humility on the part of all concerned will act as a catalyst and will speed up the eventual solution of problems which must be alleviated if we are to live in peace and harmony."15 Dummett turns politeness into a form of politics.

We are all capable of remaining true to our principles. Nothing could be easier, nothing could be harder.

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CDA JOURNAL, VOL 31, Nº4

Understanding Personality Types Can Enhance Working Relationships

In her presentation, Byers used a personality quadrant with four dominant categories that most people find they fit into rather strikingly. The four types are Relater and Socializer, which tend to be more relationship-oriented and Thinker and Director, which are more task-oriented and self-contained. The box shows the personality traits that fit each category type:

According to Byers, it is possible for a person to exhibit more than one personality type and present as a hybrid of two types; but in most cases one type is dominant over the other. It is also important to realize that although personality is largely genetic, people can be socialized in an environment in which they project a different type of personality than the one they are naturally inclined to display.

Once you identify your own personality style, it is a good idea to set aside time for your office team to classify themselves and share insights on how best to respond to their individual qualities. It is also a good tool to use to evaluate yourself and examine your own strengths and weaknesses, so that you know what traits you personally need to work to develop.

"To be a successful leader, you need to understand your own strengths and weaknesses and surround yourself with people who complement your strengths and balance out your weaknesses," Byers said.

Having a group of people with different personality types shouldn't be looked at as an obstacle, but as a chance to present a group of collective strengths. A hygienist who is a people-oriented Relater can balance out the analytical Thinker dentist. An office manager who is a goal-oriented Director can provide structure to a talkative Socializer receptionist.

"The key to staff harmony is to understand one another's personality styles and adjust work styles to fit personalities," Byers explained. "For example, a Director working with a Relater would do well to slow his or her pace, to seek input rather than barking orders, and to provide plenty of notice regarding impending changes in the office in order to be responsive to a Relater's work style. By the same token, when dealing with Socializers, Thinkers can speed up their decision-making, present only the bottom line in discussions, and capitalize on their natural ability to be detail-oriented."

In the workplace, Byers suggests trying to apply the Platinum Rule, which is: "Do unto others as they would have you do unto them." Many practices that are not running smoothly, Byers explained, are not understanding individual personality styles and tend to focus on the weaknesses of co-workers rather than the strengths.

"The best teams exist when people are able to understand each other's personalities and meet in the middle," Byers said.

To further improve the dynamics of a practice, Byers suggests personality-typing patients to figure out what kind of dentistry they will best respond to. You can train your staff, or minimally your hygienist, in understanding personalities and make a practice of noting a patient's dominant type in his or her chart. If you have a patient who is a Relater, he or she will probably ask a lot of questions and not want to make a pressing treatment decision at that same appointment. That patient should, if possible, be allotted a bit more time than a patient who is a Director, who wants it done yesterday and doesn't require a full-blown explanation.

"The only perceived downside to understanding each other's personalities is that it takes some time, and you must be dedicated to applying what you learn," Byers said. "However the benefits of a smoothly run practice can bring about great rewards."

The Relater is people-oriented, dislikes conflict, is slower making decisions, is warm, and is a sympathizer.

The Socializer is fast-paced, animated, intuitive, talkative, impatient, and involved in too many things.

The Thinker is analytical, persistent, a problem-solver, security-conscious, and always wanting to be right.

The Director is goal-oriented, a high-achiever, strong-willed, a strong decision-maker, competitive, a poor listener, and inflexible.

Toothbrush Is Invention Americans Can't Live Without

While it may seem that cell phones, computers and other technology gadgets are Americans' most coveted items, teens and adults agree that the toothbrush is the one invention they cannot live without.

The 2003 Lemelson-MIT Invention Index, an annual survey of Americans' perceptions about inventing and innovating, found that technologically advanced items significantly lag in importance behind the toothbrush, which was developed in the 15th century.

When asked to select the invention they could not live without from among five choices -- toothbrush, automobile, personal computer, cell phone, and microwave -- more than one-third of teens (34 percent) and almost half of adults (42 percent) cited the toothbrush. The automobile ranked a close second, getting votes from 31 percent of teens and 37 percent of adults.

Of the remaining choices, teens ranked the personal computer third (16 percent), the cell phone fourth (10 percent), and the microwave last (7 percent). Adults deemed the remaining choices equally important; the personal computer (6 percent), microwave oven (6 percent), and cell phone (6 percent) tied for third place.

CDA JOURNAL, VOL 31, Nº4

Scientist Finds Gene That Determines Major Sensitivity to Bitter Taste

For the first time -- in a collaboration between the National Institutes of Health, the University of Utah, and Stanford University -- scientists have identified the gene that determines the ability to distinguish a wide class of bitter tastes, according to research published in Feb. 21 issue of Science. How individuals are genetically predisposed to respond or not respond to the bitter taste of substances like nicotine and certain foods may have broad implications for nutritional status and tobacco use.

By estimates, more than 10 million American students have been offered taste testing to identify their ability to recognize or discriminate bitter taste and to introduce them to inherited traits. In more formal research, anthropologists have tested people around the world, over decades, for this same ability or inability to experience bitter taste.

Why are some people "tasters" and others "nontasters," and why is it important? The ability to taste, tested using a compound phenylthiocarbamide, is one of the best-studied inherited traits in humans. Studies over the past 70 years have demonstrated that taste variation is common in the U.S. population: About 30 percent of the population are phenylthiocarbamide (a prototype of a class of bitter substances) nontasters, while 70 percent are tasters of phenylthiocarbamide, experiencing it as intensely bitter. The ability to taste the compound has been known to be dominantly inherited.

Previous studies have demonstrated that phenylthiocarbamide status affects dietary choices. Other earlier investigation suggests that nontasters may not experience the bitter taste of nicotine in cigarettes and may be at greater risk for prolonged smoking.

Dennis Drayna, PhD, National Institute on Deafness and Other Communication Disorders, NIH, project leader of the collaboration, explained, "We have identified a gene on chromosome 7 that exists in five different forms throughout the world. One of these forms confers a severe deficit in taste ability, while the other forms produce intermediate to fully sensitive taste abilities. This gene codes for part of the bitter taste receptor complex which exists in cells on the tongue," Drayna said.

"This research promises to open a pathway to better understanding about what drives certain human behaviors including those associated with smoking and eating," said James F. Battey, Jr., MD, PhD, director of the National Institute on Deafness and Other Communication Disorders.

Virtual Articulator Offers Dynamic View of Occlusal Relations

A computer software program for the virtual articulator offers an advantage over the mechanical articulator in that the contact point situation is shown dynamically, not just statically, according to a report in the International Journal of Computerized Dentistry, April/July 2002.

The virtual articulator is intended for use as a tool for the analysis of the complex static and dynamic occlusal relations, wrote German researchers. The virtual articulator requires digital, three-dimensional representations of the jaws and patient-specific data on jaw movement. The researchers note that it simulates jaw movement and provides a dynamic visualization of the occlusal contacts.

According to the article, the observer can see how the contact points move over the cusps and in what sequence they occur. This provides the observer with more information upon which to base the diagnosis. In addition, the program also can simulate a mechanical articulator, showing tooth-guided movements.

The virtual articulator software is under development in cooperation with the University of Greifswald, Germany.

Sjögren's Syndrome and Celiac Disease Connected

Sjögren's syndrome and celiac disease have many similarities, including patients with a risk for dental problems, according to an article in the December 2002 issue of the Moisture Seekers, newsletter of the Sjögren's Syndrome Foundation.

Celiac research literature is forthcoming about the association of celiac disease and other autoimmune disorders, particularly Sjögren's syndrome, wrote Janet Y. Rinehart, former president, Celiac Sprue Association.

According to Rinehart, both diseases predominantly target women. Both diseases are referred to as syndromes and can involve many organs and body systems. Rinehart noted that both disease have unknown causes, though a genetic factor in both is likely.

Rinehart said celiac disease is the "most misdiagnosed of all the autoimmune disorders." CD is a malabsorption syndrome whereby gluten in wheat, barley, rye, and oats damages the lining of the small intestine. Individuals with Sjögren's syndrome have complications because of dryness, including lack of saliva, and use various over-the-counter products and medical procedures to ease dryness.

Both syndromes are considered rare diseases. A study from the University of Maryland Center for Celiac Research showed that celiac disease is prevalent in less than 1 in 200 healthy individuals. International research has shown a prevalence of 1 percent worldwide.

Both diseases may cause dental problems, Rinehart noted. Sjögren's patients are at risk for dental problems because of lack of adequate saliva. Patients with celiac disease have tooth defects primarily caused by lack of absorption of calcium and vitamin D.

CDA JOURNAL, VOL 31, Nº4

Reduced-Impact Baseballs and Faceguards Lower Risk of Injury

The use of safety baseballs in Little League is associated with a 23 percent reduced risk of ball-related injuries, and the use of faceguards with a 35 percent reduced risk of facial injury, according to an article in the Feb. 5 issue of the Journal of the American Medical Association.

According to background information in the article, nearly two-thirds of baseball participants are younger than 18 years old. The Consumer Product Safety Commission has estimated that up to one-third of emergency department visits for youth baseball injury could be prevented if safety balls, faceguards, and safety bases were used universally. However, this estimate assumes that these devices are 100 percent effective in preventing injury. To date, no epidemiologic study has examined the potential benefits of safety balls and protective faceguards.

Stephen W. Marshall, PhD, of the University of North Carolina at Chapel Hill, N.C., and colleagues evaluated the use of faceguards and safety balls for preventing injury in youth baseball.

"The use of safety balls was associated with a 23 percent reduced risk of ball-related injury, and faceguards with a 35 percent reduced risk of facial injury. Reduced impact balls appeared to be the most effective type of safety ball (28 percent reduction). There was no compelling evidence of any difference between plastic and metal faceguards," the researchers wrote. Safety balls appeared to be more effective in the minor division (ages 7-12 years) than in the regular division (ages 9-12 years).

The authors wrote that a wide variety of safety balls are currently used in youth baseball. These include tennis balls, rubber balls, cloth balls, and a special type of ball generically known as the reduced impact ball. The reduced impact ball is designed to look and play like a regular baseball but has greater deformation on impact than traditional balls, lowering the force transmitted to the child. Protective faceguards are worn when the child is at bat and when running the bases. The faceguards studied were largely made up of metal mesh guards and the clear plastic protective visors.

Dental Profession Working Together for Dental Education

The dental profession is banding together to pull dental education out of its downward spiral, reported Janyce Hamilton in the December 2002 Review, publication of the Chicago Dental Society.

According to Hamilton's report, dental education is taking hits from two directions. Nationwide in 2002, the number of vacant faculty positions continued to increase, while dental school class-size enrollment rose.

Hamilton noted that American Dental Association Survey Center data show that from 1990 to 2000, the average number of vacant faculty positions per dental school increased from 4.3 to 6.5. During the same period, enrollment rose 9 percent.

Dental schools with unfilled openings report few dentists respond to their advertisements, and some of those who do are not qualified. The article states that the total number of all types of faculty members who separated from dental schools in 2001-02 was 1,011. Hamilton noted that although this is nearly triple that of the previous period, part of the increased number is due to better reporting.

According to Hamilton's article, the No. 1 destination of departing faculty is private practice.

Hamilton reports that the ADA and its Council on Dental Education and Licensure are pursuing the problem full force. ADA leadership has passed several resolutions to deal with the problem. The ADA held two dental education summits with eight dental specialty organizations in attendance, as well as the American Dental Education Association and others.

Hamilton's article discussed several problems in dental education and some proposed solutions. Problem areas include income disparities between private practice and academia, soaring student loan debt, tuition waivers/student stipends, mentoring, and the economic downturn.

The ADEA's suggested strategies include:

* Recruiting from military, federal services, and private practice;
* Developing nontraditional methods of compensation;
* Recruiting from within;
* Developing scholarships, research grants, and loan-forgiveness programs; and
* Developing new media to enhance interaction between schools and employment seekers.

CDA JOURNAL, VOL 31, Nº4

Prosthodontic Treatment Planning: Current Practice, Principles, and Techniques

Roy T. Yanase, DDS

Contributing Editor

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Treating the prosthodontic patient has its challenges and rewards. Prosthodontic treatment planning has progressed from an emphasis on planning for immediate dentures to immediate loading of implants. Even with today's extended average lifespans, patients expect to keep their teeth for a lifetime. Dentistry has followed new technology into the future to provide excellence in prosthodontics and restorative dentistry.

Concepts and materials have been developed to help simplify the treatment for esthetic procedures, implants, and removable and fixed prostheses. Selection of appropriate restorative materials requires knowledge of the latest techniques and options. It is the challenge of all dental journal editors to present the most current information to their readers.

The faculty of the University of Southern California New Odontic Seminar has selected the 25 years of documented dental treatment of patient "AK" (see following article) as a foundation on which to base discussion of the concepts and technology that have developed in prosthodontic treatment planning. Each of the contributing authors was asked, "What are your thoughts retrospectively if you were to treat the patient AK' in your practice today?" And, since all dentists are challenged with evidence-based treatment planning, each author was also asked "On what evidence in the literature do you base your treatment planning for patients who need prosthetic therapy?" While some references may seem redundant, they only reflect the effect of the current literature on applications of the principles reported. Dentistry's experience with long-term success of endodontics, periodontics, and implant dentistry is expressed in the presentations discussing when an implant may be better suited for a prosthetic abutment than a restored tooth.

50 Years of Prosthetic Dentistry

The first guest editorial in the Journal of Prosthetic Dentistry more than 50 years ago cautioned future contributors and editors to be aware of the hazards of magic, work juggling, authority, and emotion.1 The Journal of Prosthetic Dentistry has used the power of progress to develop better problem-solving techniques for the prosthetic patient.

In that first issue, Hughes and Aseltine outlined mouth preparations for the transition from natural teeth to dentures.2,3 Swenson identified two factors important in complete denture service -- a favorable attitude and favorable oral and residual ridge conditions.4 Bliss identified psychological factors to consider for patients about to lose their natural teeth.5 Hardy outlined the development of various tooth forms,6 and Schultz offered cast gold as a method of increasing chewing efficiency with complete dentures.7 Pound emphasized that esthetics and the occlusal vertical dimension can be established by phonetics.8 Most importantly, Kyes called

for more communication between the dental technician and dentist to produce excellent dentures.9

The U.S. Surgeon General's Report on Oral Health identified the opportunities for dentistry on behalf of the nation's oral health.10 With the acceleration of science into clinical practice, the report highlights the assessment of risks and benefits and the education of patients about oral health. The report makes it imperative for health professionals to ensure appropriate referrals to practitioners in various areas of health care. For the totally and partially edentulous patient, the introduction of the art and science of osseointegration has changed diagnosis and treatment planning with documented effective and successful treatment options.

From Implantology to Implant Dentistry

The use of implants in dentistry can be traced to Central and South America, Egypt, and even prehistoric times.11 Early implantology documentation began with surgical and restorative combination efforts to replace missing dentition with an immediately supported and stabilized restoration following the placement of implant forms. Gold screws, shaped forms, baskets, and blades had various rates of survival.12 The mandibular subperiosteal implant denture aroused the interest of implantologists to secure a prosthesis immediately after placement. Forty-year survival rates of 66 percent (41 patients)13 and 100 percent (20 patients)14 have been reported. There have been no long-term survival studies reported on bladed implants or subperiosteal implants in the maxillary arch. These survival results were among the best presented at the 1978 National Institutes of Health Harvard Consensus Conference.15

In 1975, Wilkie established the concept of specialists working together as a team. For preprosthetic success, "A mutually cooperative effort between the prosthodontist and oral and maxillofacial surgeon must exist during the diagnostic procedures, be maintained through the various stages of treatment, and prevail through the follow-up care of the patient. Each must be aware of both the objectives and possible limitations of the treatment the other will provide to ensure optimal care for the totally edentulous patient."16 A multitude of preprosthetic procedures that developed aimed at solving the problems of the edentulous mandible.17,18 The emphasis changed from one dentist being responsible for the ultimate success of implant surgery and implant restoration to that of a shared responsibility for surgical and restorative phases.

Having completed the first replication of Brånemark's work and convinced of its scientific merits, in 1982, Zarb organized the first conference on osseointegration in North America.19 The conference underscored the intimate ties that linked research, education, and clinical practice; and the public was to receive the benefits of implant dentistry safely, predictably, and effectively. Since that time, a series of symposia has been organized to bring together the research, development, and applications that document continued benefits and success of implants in clinical dentistry.20-27

There are few, if any, outcome assessments that compare patient-mediated factors of success such as longevity combined with physiologic, psychosocial, and economic factors.28 With the complexities of multiple-implant-supported restorations, more time and study are required to standardize the benefits and minimize the risks. Clinical observation and careful long-term followup of treated patients gives valuable insights into the selection of an implant system (There are 55 currently available) and planning of the restorations, including the many risks of site development.29-31 Esthetic demands and biomechanical considerations complete the complexity of the treatment planning process.32

In many other countries, all dentists are required to complete all aspects of implant therapy and thus carry a heavy burden of responsibility for long-term success. To learn and practice with the latest techniques and information requires intense study and practice.

The team approach remains the mechanism for more surgeons and restorative dentists, studying together, to participate and provide a predictable and safe treatment modality for a greater number of patients.33 Advanced education is possible to allow single practitioners to train in both surgical and restorative disciplines and practice solo implant dentistry. During this process of education, the standard of care in restorative dentistry relies on the blend of fixed, removable, implant, and maxillofacial prosthetic dentistry principles and appliances. The standard care in surgical protocols requires a thorough understanding of prosthodontic treatment planning principles, placement, and the management of complications following implant placement. The new paradigms in treatment require a fresh look at the probability of short- and long-term complications of grafting and pre-implant procedures as well. A complete review of the available options and the benefits and risks of treatment is essential for informed consent or informed refusal of the proposed treatment.34-37

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CDA JOURNAL, VOL 31, Nº4

AK Patient Presentation

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Amsterdam1 eloquently established that prosthodontic treatment of the advanced periodontal patient requires the application of fundamental fixed prosthodontic principles, surgical periodontal procedures, and more-complicated treatment techniques. It is multidisciplinary in nature. Often, control of the situation is tenuous at best, making these treatment plans exponentially more difficult than normal. The advanced periodontal patient is characterized by crown-to-root ratios of 1:1 or greater, tooth mobility, occlusal traumatism, posterior occlusal collapse with anterior tooth migration, loss of occlusal vertical dimension due to wear, tipping or loss of posterior teeth, and often, multiple missing teeth.

The goals of prosthodontic treatment in these situations are:

* To provide posterior occlusal support to maintain the vertical dimension of occlusion and prevent displacement of the anterior teeth. This requires bilaterior posterior bone-borne tooth-to-tooth stops. The vertical dimension of occlusion may be reduced at the expense of the more crippled arch to improve the crown-to-root ratio and direct forces along the long axes of teeth;

* To create an occlusal scheme that provides anterior guidance to disarticulate the posterior teeth and prevent harmful lateral forces in excursive movements and

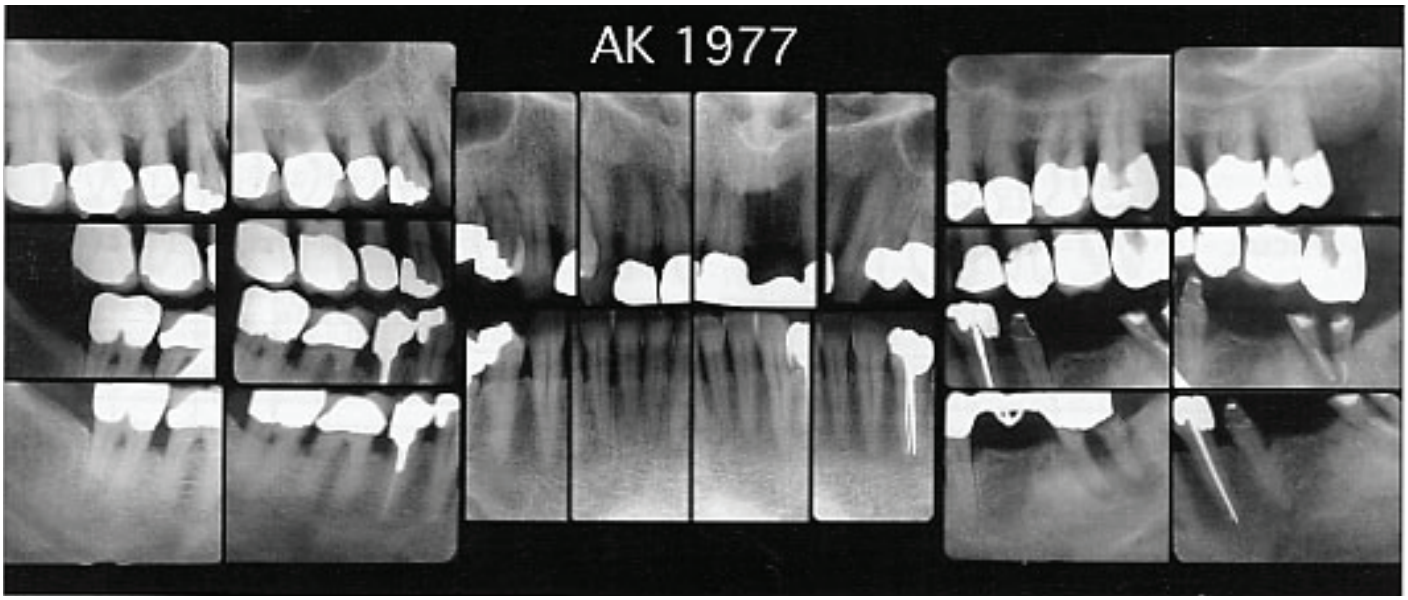
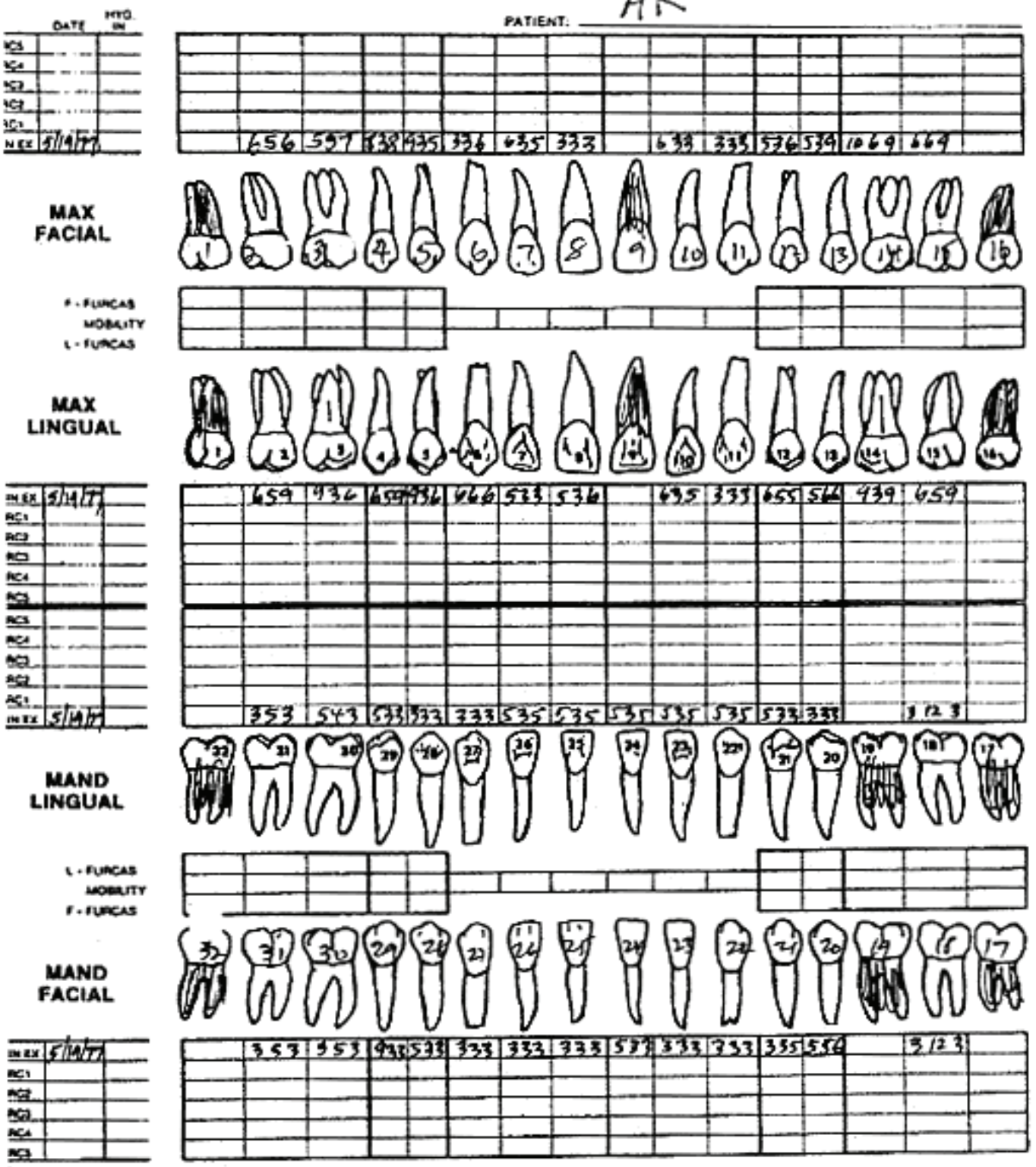


Figure 1. Full-mouth pretreatment X-rays, 1977.



Red: All first probings 4 mm or deeper
Recall probings same depth or deeper.
Mobility - Record Class I, II, III, etc.

Red: "F" = Fremitis - record on mobility lines
"S" = Suppuration - next to recorded depth

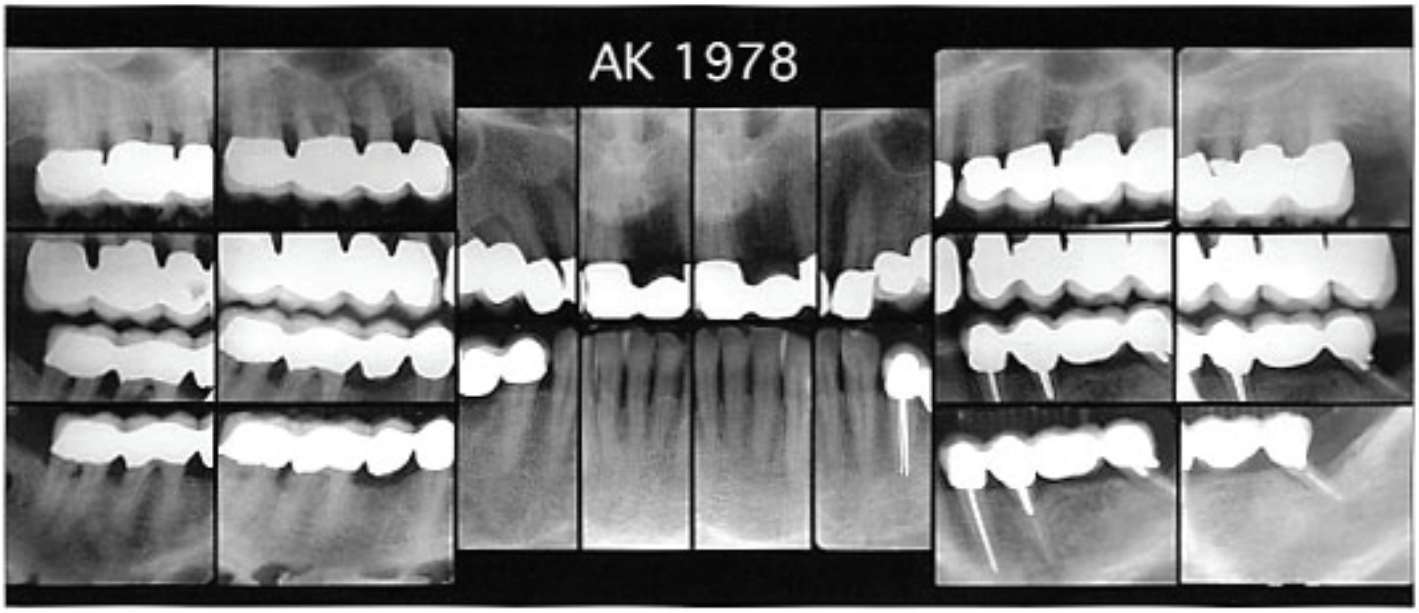


Figure 3. Full-mouth post-treatment X-rays, 1978.

axially loaded posterior teeth to prevent displacement of the anterior teeth;

* To stabilize the teeth to reduce or eliminate secondary occlusal trauma by splinting in a straight line or cross arch;

* To replace missing teeth as necessary to achieve these goals;

* To create restorations that preserve the biologic width and enhance, not impede, oral hygiene; and

* To promote a sense of well-being for the patient.

Inherent in the traditional perio-prosthodontic model is the premise that natural teeth are to be retained as long as possible. Since periodontal disease is a disease of progressive deterioration characterized by plateaus of stability and maintenance, study of this progression provides guidelines on how to rethink treatment planning.

AK, a 40-year-old female in good health, presented in May 1977 (Figure 1) because she was aware of a loose bridge on her lower left. Missing tooth No. 19 was replaced with a three-unit fixed partial denture and No. 18 was carious through the furcation, with both residual roots independently mobile. The restoration was removed, caries excavated, and she was sent for endodontic therapy of the residual roots to see if they stabilized. A comprehensive examination was performed. The existing restorations were more than 10 years old. She was referred for periodontal evaluation. The initial periodontal diagnosis was acute/chronic severe adult periodontitis with generalized horizontal bone loss and areas of vertical bone loss and furcation involvements, especially the posterior teeth. Pretreatment periodontal probings are shown in Figure 2. Her medical history was unremarkable, and there were no social habits believed to be contributory to her periodontal condition. Full-mouth pocket elimination therapy was performed. All infraboney defects were eliminated. There were no root amputations since the horizontal aspects of furcations were eliminated by surgery and fluted tooth preparations. Postsurgically, teeth Nos. 4, 5, 12, 13, 14, and 15 exhibited class I mobility; and the crown-to-root ratio of the maxillary arch was compromised. Therefore, all teeth except the lower anteriors were restored, the vertical dimension was reduced at the expense of the maxillary arch, and the posterior quadrants were each splinted. The mesial root of No. 18 was stable and used as a posterior abutment (Figures 3 and 4). An occlusal guard was fabricated for nighttime wear. The root of No. 18 lasted six years and was replaced with a unilateral subperiosteal implant, which failed after one year and was removed. A single osseointegrated implant was then placed, ultimately fractured, and was removed. During the more than 20-year period following periodontal surgery, AK was maintained periodontally every three months. Her home care was considered above average. A full-mouth series of radiographs in 1987 (Figure 5), 10 years after she first presented, shows all furcations deeply involved. Nos. 15 and 31 were removed (after 10 years) while the rest were maintained. After 14 years, two osseointegrated implants were placed on the mandibular right (due to No. 30) and restored from Nos. 29 through 31. Also after 14 years, in 1991, the remaining maxillary posterior teeth were removed, rest preparations made in the existing

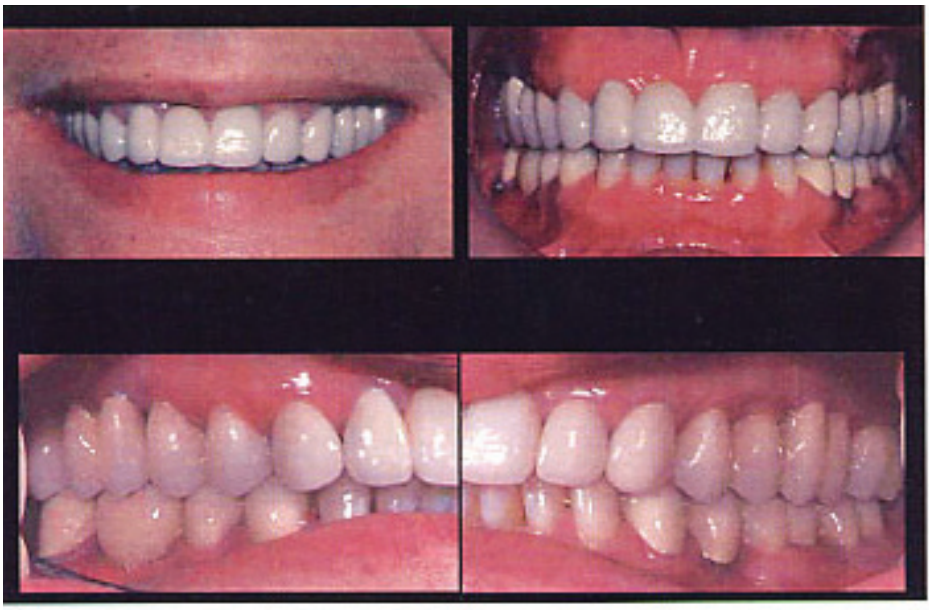


Figure 4. Post-treatment photographs, 1978.

anterior crowns, and a maxillary bilateral distal extension removable partial denture fabricated. Due to further alveolar bone loss from the periodontal deterioration during the 14 years, implant placement in the maxillary posterior quadrants was not possible at that time without sinus grafting/bone augmentation procedures. After 21 years, Nos. 20 and 21, supporting a third premolar cantilever, failed endodontically; and the mandibular left quadrant was restored with three osseointegrated implants. As of today, 25 years after AK presented, maxillary anterior restorations are still in place, and the removable partial is 11 years old (Figure 6). The mandibular left and right osseointegrated implants are stable and maintained, and the anterior teeth are still unrestored.

It was not possible to know in 1977, but, in hindsight, AK had downhill progressive refractory periodontal disease, i.e., no matter the excellence of her level of oral hygiene, nor the excellence and compliance/frequency of maintenance therapy, though there were some plateaus of stability, her periodontal condition would still continue to deteriorate. Fortunately for AK, the existence of periodontal disease is not a contraindication or deterrent to implant therapy.

There is a body of evidence of implant success that is now the foundation of predictable treatment planning. The decision of when to extract, how to handle edentulous spaces, and when and where to place implants is evolving. There is a point at which an osseointegrated implant is more predictable than a retained periodontally or endodontically involved tooth. In the consideration of the overall oral condition and the prosthodontic needs of the patient, every edentulous space is a potential implant site.

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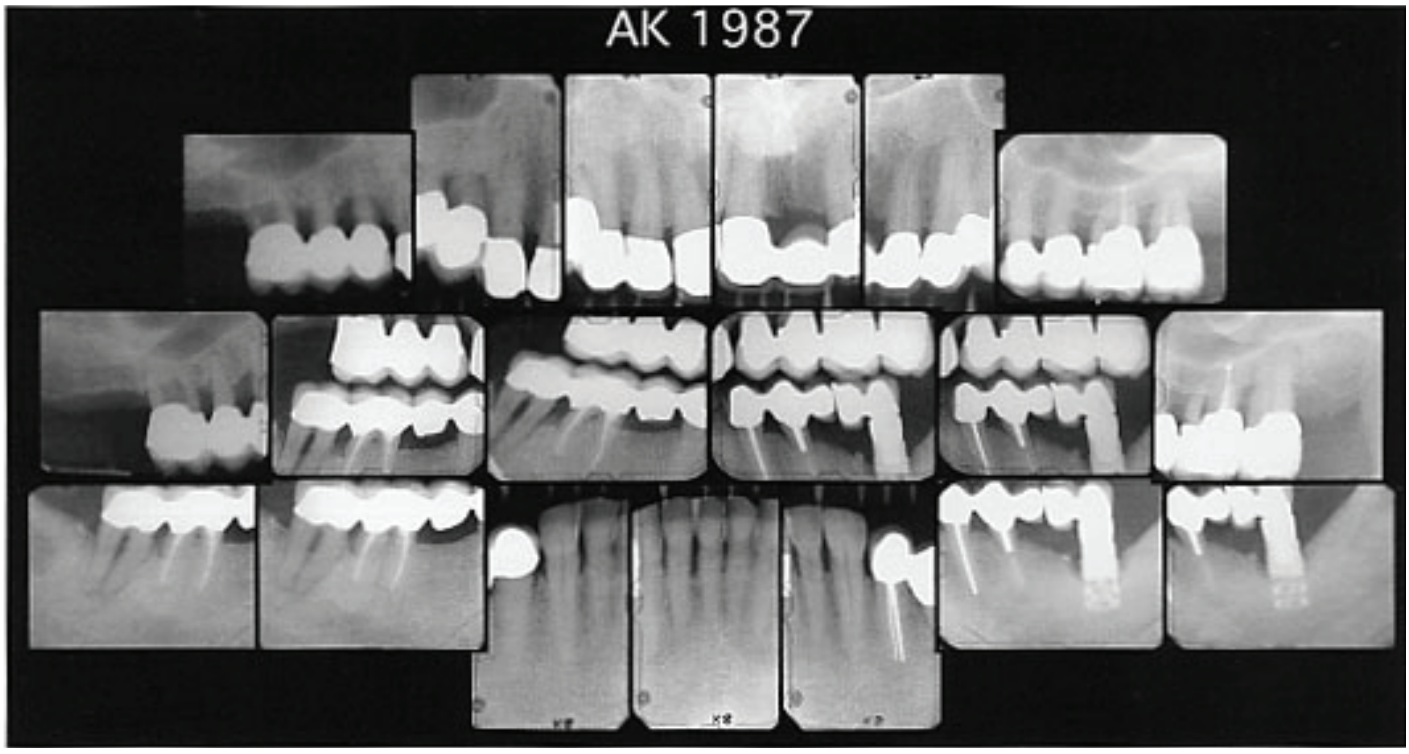

Figure 5. Full-mouth X-rays, 1987.

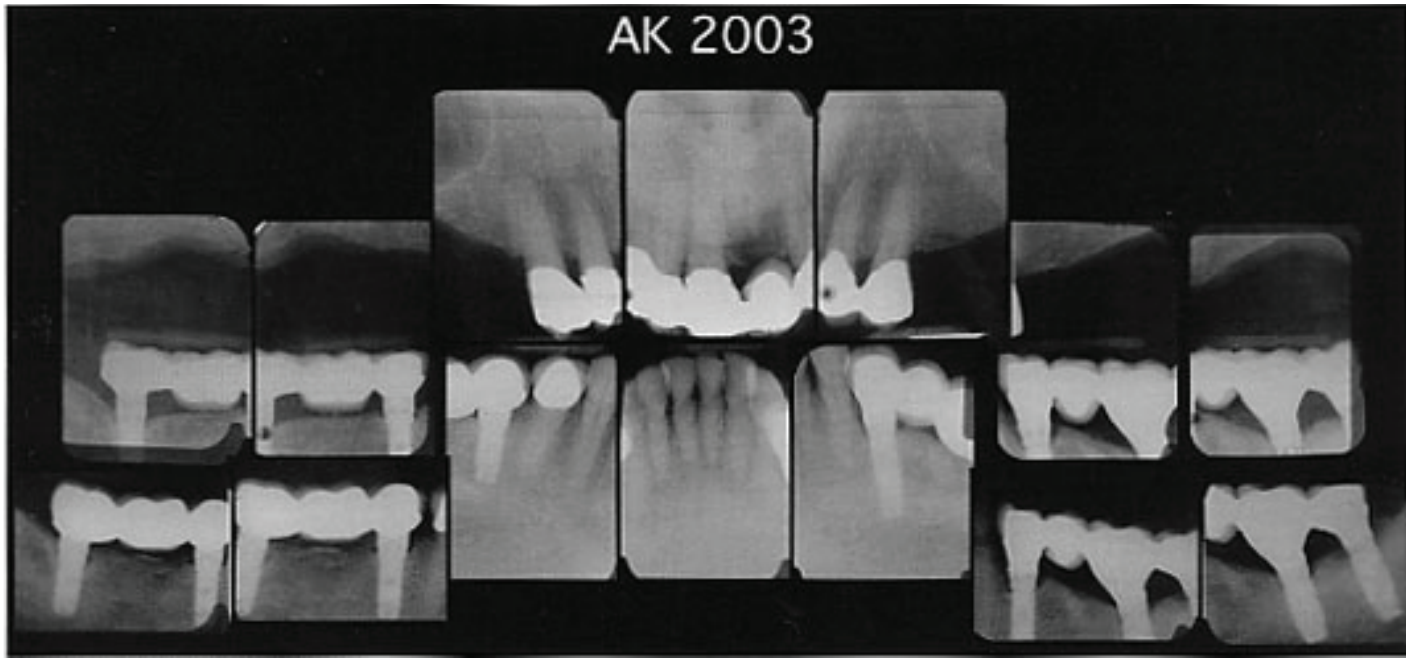

Figure 6. Full-mouth X-rays, 2003.

CDA JOURNAL, VOL 31, Nº4

Perio-Prosthetic Treatment Planning in Implant Dentistry

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When reviewing the literature on perio-prosthetics, Amsterdam's article on 25 years in retrospect1 is the classic paper that documented and taught the multidisciplinary approach to treating the compromised dentition.

Treatment protocol using orthodontics, endodontics, and periodontics in conjunction with prosthetic rehabilitation of the periodontally compromised patient to create the classic perio-prosthesis has greatly changed. Treatment planning the patient with periodontal disease (such as A.K.) has changed, thanks to implant-supported dental reconstruction. Periodontally involved teeth with poor prognoses do not need to be relied upon as abutments for multiple-unit prostheses. However, the above-mentioned conventional techniques still have their place in the medically compromised patient.

With the increasing success of dental implants, the accepted standard of care is dynamically changing. It has become unacceptable for the dental professional to neglect offering implants as an option when treatment planning for patients with missing or compromised teeth. As Rempfer2 pointed out in a 2002 demographic analysis, there is an exponential increase in demand and patient expectation in optimal dental treatment.

When considering the periodontally involved patient, the challenging issues in treatment planning are not the teeth with poor or hopeless prognoses, for which the treatment is obvious, but the teeth that are fair to guarded in their prognoses.

The dental practitioner enters a gray area if he or she needs to make an evidenced-based decision about whether to extract a tooth with a fair prognosis and replace it with an implant with an excellent prognosis. Implant success rates are high, 93 percent to 98 percent,3,4 depending upon the patient, area of placement, bone type, and implant surface and type. To determine the treatment prognosis for a patient with moderate to advanced adult periodontitis or high periodontal susceptibility, accurate risk assessment is essential.

Factors Influencing Evaluation of Risk

Wilson described individual risk factors affecting the prognosis of the periodontally involved patient and emphasized the importance of risk assessment in treatment planning.5 Some of the factors to consider when evaluating risk are diagnosis of periodontal condition, patient compliance,6,7 genetic susceptibility,8-11 and smoking.12-15

Evaluating Prognosis of Treating Patients With Chronic Periodontitis (Patient A.K.)

Hirschfeld and Wasserman16 looked at 600 patients who were treated for periodontal disease over a 22-year period. During the observation period, 50 percent of the patients did not lose any teeth, 33 percent lost three teeth, 12 percent lost nine teeth, and 4 percent lost 25 teeth. Thirty-one percent of questionable teeth were lost. The authors concluded that tooth loss was related to case type, not treatment performed. The extreme downhill patients are classified as having aggressive periodontitis and/or refractory periodontitis.

McFall17 studied 100 patients over 15 years and concluded that tooth loss was symmetrical, with the maxillary second molars being the most susceptible, and the mandibular cuspids the most likely to survive. Over the 15-year evaluation, 9.8 percent of teeth were lost to periodontal disease. Goldman and Ross18 did a similar retrospective study over 15 to 34 years and drew similar conclusions.

Consequently, patient A.K. -- with refractory periodontal disease, early extraction in the posterior maxilla, and implant placement -- would offer excellent prognosis without involved site development (sinus grafting and staged implant placement).

Becker,19 Bahat, and Handelsman20 show success rates of 95.7 percent and 96.3 percent with dental implants in the posterior maxilla.

When to Extract

Optimum prosthetic treatment should be restorative-driven rather than bone-driven implant positioning.21,22 The challenge is to evaluate how much bone the patient can afford to lose before compromising an implant site, without having to do additional grafting procedures to regain bone volume. A desirable goal in reconstructive treatment planning is to achieve longevity without duplicating surgical intervention in the short term. In patient A.K., early extraction of maxillary posterior teeth would have enabled simultaneous sinus grafting and implant placement. In 1991, patient A.K. would have required more-extensive sinus grafts, four to six months of healing, and implant placement. Several surgeries and an extended restorative timeline would be required.

Resective Procedures

Blomlof reported survival rates of root-resected molars were 27 percent over 10 years. High failure rates were due to persistent periodontal breakdown.23 Langer and Stein reported 66 percent success over 10 years, where 50 percent failed due to root fractures.24 Carnevale report 93 percent success over 10 years, but patients were kept on a strict hygiene maintenance protocol.25

The 1989 World Workshop in Clinical Periodontics26 concluded: "Root resective procedures may be performed only where other therapeutic approaches are not considered feasible and a very strategic tooth is involved."

In Hirschfeld and Wasserman's16 study, 31 percent of the lost teeth were due to furcation involvement. In McFall's17 study, 50 percent of the molars with furcation involvement were lost after treatment.

One needs to balance the success rates of specific periodontal procedures with the increasing implant success rates and long-term prognosis. In patient A.K., resection of No. 18 served the patient for six years. Early extraction of No. 18 and implant placement in Nos. 18 and 19 positions would be the current treatment of choice. This would separate the risk from teeth with a dubious prognosis.

Conclusion

Current perio-prosthetic treatment planning involves accurate risk assessment. Implant therapy must be considered an integral modality in treatment planning. Plan to individualize risk to individual teeth or implants, without incorporating splinted teeth or long-span fixed partial dentures. Today, treatment for patient A.K. would involve the following sequence of therapy: initial therapy, scaling and root planing, caries control, evaluation of periodontal prognosis of remaining teeth and occlusal forces, extraction of hopeless teeth, teeth with poor prognosis used for interim fixed provisional prosthesis (develop occlusal scheme and staged implant placement), site development and grafting, implant placement (immediate placement, immediate load, one-stage, two-stage), and restoration.

Acknowledgment

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Treatment Planning for the Future: Endodontics, Post and Core, and Periodontal Surgery -- or an Implant?

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After the early years of unpredictable and problematic results, dentistry now has dental implant procedures that mimic traditional restorative techniques and offer an extremely high degree of success and predictability. Dental practitioners now accept the validity of the use of endosseous dental implants to replace the traditional fixed partial denture, especially when the natural abutments for that fixed prosthesis have minimal or no existing restorations.1 However, it is time to expand the use of dental implants in day-to-day restorative treatment planning. Despite every effort to provide superior care, the unavoidable cascade of events seen in the "A.K." case history demonstrates the limitations of dentists' abilities when traditional therapies are inadequate to overcome the weaknesses that patients present. Rather than rebuilding a badly compromised but still "restorable" tooth, dentists now need to reconsider their approach to its restoration. Given advances in implant therapy, it is now appropriate to consider the "early" removal of marginal teeth. Although dentists had no previous choice but to rely upon compromised teeth as key elements in restorative plans, a more predictable and successful result may be possible by their early replacement with one or more dental implants. In many situations, a single-tooth implant offers improvements in ease of restoration, preservation of alveolar bone, superior strength, predictability, and survivability as compared with the natural tooth that requires an elaborate rebuilding procedure following endodontic therapy. In addition, the implant-supported restoration may frequently be more economical, since initial costs are similar; and the weakened endodontically posted tooth will very likely require follow-up care or removal at a later time, increasing complexity and expense.

The A.K. case history illustrates a number of sophisticated, traditional restorative treatment procedures that remain in common use today. In the past,

dentists were often obliged to rely on debilitated natural teeth to support a crown restoration, fixed bridge, or removable partial denture. A debilitated tooth has a guarded long-term prognosis as a restorative abutment, since all or most of the coronal tooth structure is lost, its root has a thin cross-section or is "hemi-sected" or short, or the tooth has a compromised periodontal attachment. Endodontics, periodontal therapy, and the placement of a post and core were regularly needed to restore these teeth prior to the final restoration. Even when well done, the final root and post "complex" remains an unavoidable weak link under our final restorations. When under routine functional load, let alone the stresses associated with being an abutment for a fixed or removable partial denture, such teeth are often subject to catastrophic failure.

Studies show that if adequate tooth structure remains in a posterior tooth after endodontics, a cast restoration is adequate to preserve its strength; and it can support a crown or serve as an abutment without the need for a post or post and core.2 This consideration remains valid. Endodontic posts provide no additional strength to the tooth and increase its risk of fracture.3 The risk of root fracture increases in teeth that have larger post spaces, thin root walls, or when short posts are used to support a core.4 Reports of post and core failures due to root fracture range from 3 percent to as high as 10 percent. Furthermore, loosening of posts is an even more common occurrence than root fracture, leading to additional endodontic post and final restoration failures.5

A comparison of the survivability of debilitated teeth to the success rates for single-tooth implant-supported restorations, shows significant improvements in implant survivability over natural teeth. Priest reports a 97.4 percent survival rate of single-tooth implant restorations and, even more importantly, a concomitant stability in the health of the untouched adjacent natural teeth in a 10-year retrospective study.1 This is highly significant because if a traditional fixed partial denture were to be placed, the potential need for subsequent therapy (typically endodontics due to pulpal stress or retreatment due to recurrent decay) would greatly increase overall treatment costs with time.6

Dental professionals must therefore recognize the fact that the preservation of debilitated natural teeth, no matter how "noble" a concept, may offer patients a poorer prognosis than the early removal of such teeth and their pre-emptive replacement with a dental implant. Treatment planning paradigms need to be updated to reflect these changes. Instead of routinely restoring debilitated and/or endodontically treated teeth, dentists need to evaluate them as follows:

* Teeth that have unusually enlarged root canal spaces or roots with thin peripheral walls are prone to root fracture when in function. These teeth should be removed and replaced with a dental implant so that the prosthesis they support will not be compromised later. This is of particular concern when these teeth are to be used for abutments for fixed or removable prosthetics to avoid the failure of the entire restoration and bone loss. The greater the functional load, the more likely this is to occur.

* Teeth that have little remaining coronal tooth structure should also be evaluated for removal and replacement with a dental implant unless there is significant bulk to the root. Proper post-endodontic restoration of a badly broken down tooth requires the use of a long post that is placed without weakening the walls of the remaining root structure or harming the apical seal. The greater the loss of coronal tooth structure and the shorter the root, the less resistance the post and core has to dislodgment, leading to the failure of the overlying crown or fixed partial denture.6

* Teeth with very poor crown-to-root ratios should also be considered for early removal and replacement if adequate bone support for a dental implant is available or can be developed without undue difficulty. While the ongoing loss of alveolar bone must be averted for successful implant placement, the literature also supports that 15 percent of teeth that require periodontal surgery prior to prosthodontic treatment will also require root-weakening endodontic therapy after restoration.7

* Long-span fixed partial dentures abutted on endodontically treated teeth often have a poor long-term prognosis. Instead, the placement of multiple implants will provide superior support to the arch and the separation of individual teeth, minimizing the complications associated with long-span restorations.

* Teeth that have adequate bulk to restore but do not respond to endodontic retreatment should be evaluated more critically than they have been in the past. Prolonged or ineffective healing will destroy needed alveolar bone and complicate future implant or other restorative procedures.

* The successful long-term restoration of an endodontically treated posterior tooth that has adequate coronal tooth structure can routinely be accomplished without the need for a post or post and core.6 However, if a tooth lacks coronal integrity, dentists must now also consider the effect that its debilitated condition will have on its long-term prognosis, and compare that to its prognosis were it to be replaced with a dental implant.

* Anterior areas present other is-

sues, as the need for precise control of gingival architecture and the preservation of the gingival papillae are critical esthetic issues. When there is adequate tooth structure, the literature supports that a minimal restoration of the natural tooth is adequate.6 When implant replacement is required, a careful team effort between periodontist or surgeon and restoring dentist is indicated to ensure optimal anterior esthetics.

In conclusion, dentists become accustomed to those techniques that they believe will provide their patients with a high level of predictability and success. Their instincts direct them to preserve every tooth they possibly can, just as was done for patient A.K. However, dentistry must continually evaluate the merit of traditional methods and compare them to advances, so that dentists can offer their patients the benefits of proven technological innovations. The literature now offers significant substantiation that implant-supported restorations represent efficacious and effective improvements over the use of the traditional endodontic, post and core, and periodontal surgery (or crown-lengthening) techniques needed to rebuild badly compromised teeth as in the A.K. case history. Dentistry therefore needs to rethink its traditional approach to treatment planning for these teeth with a long-range perspective. As always, the dental practitioner needs to confer with his or her patient as to the consequences of treatment planning decisions. The challenge to dentists is to "look ahead" for their patients and, through an understanding and appreciation of the long-term potential that dental implant technology offers, recognize how and when treatment planning must change. This process will require dentists to expand their "comfort zones" and incorporate the use of dental implants at a far earlier point in their day-to-day restorative treatment planning.

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Treatment Planning Considerations: Questionable Teeth or Implants

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The decision concerning treatment planning should be based on the most predictable procedures that will benefit the health and function of the patient. When deciding upon the proper restorative treatment, the clinician is faced with a dilemma about whether to keep or extract teeth with questionable prognoses, as illustrated with the patient "A.K." It is well-accepted that the individual prognosis of each tooth can influence the prognosis of the outcome. However, since the success of the restoration is more important than the individual tooth, the decision to keep or extract an individual tooth should not be based on its prognosis alone but on the prognosis of the whole prosthodontic rehabilitation and the patient's benefit.1

When designing a treatment plan, it is generally acceptable to maintain teeth with good prognoses and extract teeth with hopeless prognoses. Nevertheless, there is no consensus as to the proper treatment of teeth with questionable prognoses.1-8

A tooth may have a compromised prognosis from a periodontal, restorative, endodontic, and prosthodontic perspective. Different criteria have been suggested to define teeth as periodontally questionable.9-11 McFall12 followed the criteria of Hirschfeld and Wasserman9 and categorized a tooth as questionable if it had furcation invasion, deep non-eradicable pocket, extensive alveolar bone loss, or marked mobility grade II or more in conjunction with pocket depth and alveolar bone loss. He further demonstrated in a 15-year study, 43.3 percent to 60 percent of the teeth with questionable prognoses were lost even though they were subjected to periodontal therapy and proper maintenance.12 Spear discussed the prognosis of a single tooth from a restorative point of view and suggested a minimum of available tooth structure as a guideline for retaining a tooth.5 Lewis discussed the management of teeth with questionable prognoses from a prosthodontic perspective. He suggested that

in a prosthetic rehabilitation, the extraction of natural teeth should not depend upon the health of the individual tooth but rather on the success of the overall rehabilitation planned and the long-term service provided to the patient.1

The introduction of osseointegrated dental implants has presented the profession with additional treatment options.13-15 Dental implants can now be used predictably and serve as long-term abutments for various prostheses.8,14,16-21

Dental implants present several advantages over questionable teeth. From a restorative perspective, dental implants are made of materials with known physical properties that can provide standardized structural durability as abutments. Dental implants are not subjected to caries and may be used successfully even in caries-prone individuals.

From a prosthodontic perspective, implant placement is planned according to the requirements of the desired prosthesis. Therefore, with the use of dental implants, optimal number of abutments with adequate length and diameter can be placed to support the prosthesis as needed.

From a periodontal perspective, it has been demonstrated that the bone surrounding dental implants remains relatively stable over time. The use of dental implants to support prostheses has been shown to preserve adjacent remaining alveolar bone.22,23 Furthermore, it has been shown that dental implants are successful in oral rehabilitation of patients treated for periodontal disease. Implants placed in partially edentulous patients treated for generalized chronic periodontitis and generalized aggressive periodontitis demonstrated high success rates.24

The issue of whether to retain questionable teeth or replace them with dental implants has been debated in the literature.1-4,6,7 The maintenance of questionable teeth often requires advanced endodontic, periodontal, and restorative procedures in heroic attempts to salvage them.25-27 These extensive procedures are not only costly but also time-consuming and have various degrees of success.

Even if the procedures to salvage questionable teeth are successful, it has been shown that such teeth have an unpredictable periodontal prognosis.12,28-31 Questionable teeth do not provide optimal support as abutments for prostheses due to their reduced hard- and soft-tissue support or compromised structural integrity and may jeopardize the success of the restoration.

Teeth with questionable prognoses may continue to lose bone and soft tissue as their condition deteriorates.22 Tissue loss may adversely affect the adjacent teeth, compromise esthetics, and put the success of the restorations at risk. Furthermore, continuous bone loss around questionable teeth may also compromise the future placement of dental implants. When such teeth are finally diagnosed as hopeless and extracted, they leave a residual ridge that may not be adequate for implant placement. This may result in a compromise in implant length, diameter, location, or angulation, or may require additional augmentation procedures with various degrees of success that may jeopardize the prognosis of implants.

The treatment of patient A.K. presents a situation where questionable teeth were restored and maintained due to lack of better alternatives. Today, however, dentists know that a proactive approach is necessary to prevent this destructive process. Early intervention and extraction of questionable teeth should be considered to prevent the bone loss involved in maintaining these teeth. Dental implants can replace the questionable teeth, thereby providing a more predictable root replacement than a compromised tooth and a more stable foundation for the prosthesis by enhancing the predictability of the rehabilitation.

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Treatment Considerations of Fixed Prosthetic Restorations of the Compromised Dentition vs. Alternate Fixed Implant-Supported Options

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The treatment of the patient "A.K." needs to be evaluated with regard to what was done, what alternatives could have been done in light of current treatment modalities, and whether the alternative treatments would have had an effect on the patient's prognosis and additional treatment. Evaluating the use of the fixed prosthodontic restorations, this patient had periodontally involved teeth, caries, bone loss and secondary occlusal trauma, and mobile teeth. Fixed restorations were fabricated using a hemisected tooth, endodontically treated teeth with post-cores, subperiosteal and endosteal implants, and splinted natural teeth.

Long-term studies of fixed prosthodontic restorations utilizing teeth or implants for support and anchorage are not necessarily parallel in their methods, criteria of success, and patient populations. Review of the existing literature for indications of patient response to various treatments can provide insight into making alternative treatment choices.

Evidence for Fixed Restorations Supported by Teeth

The long-term survival of tooth-supported fixed partial denture restorations is very good in the first five years, with success rates of 95 percent and better. However, these results drop to 68 percent to 85 percent after 15 years.1-3 Two meta-analysis studies by Creugers4 and Scurria5 also show that the cumulative data of seven and eight studies show 74 percent and 69 percent success respectively after 15 years.

Goodacre compiled data from these and other studies and reported that the main causes of failure for fixed prostheses were caries (33 percent), loss of retention (26 percent), periodontal loss (11 percent), and abutment fracture (4 percent). In addition, this same review showed that there was increased failure with splinting teeth, longer edentulous spans, cantilevered pontics, endodontically treated teeth, and fixed partial dentures that included both anterior and posterior teeth.6

When using root-resected molars,

Figure 1. Paradigm shift in implant therapy: Patient's left side was restored in 1996, to replace a failed bridge Nos. 18 x 20 x 22 due to caries on No. 20. Restoration included two implants in No. 19 mesial and No. 20 positions, and two CSR attachments connecting the implant segment to crowned natural teeth, constructing a five-unit prosthesis. Patient's right side was restored in 1998 replacing a carious No. 29 abutment of a bridge Nos. 29 x 31. A satisfactory abutment crown was left on tooth No. 31, and individual implants were restored replacing No. 29 and 30. This restored all teeth as single units, and tooth No. 28 was not involved.

Blomlof and colleagues7 reported 10-year results of 56 percent in periodontally compromised patients, but as high as 89 percent in healthy patients. Basten and colleagues8 reported a 92 percent 12-year survival rate for resected molars. Most failures were due to caries, endodontic failure, or strategic treatment planning decisions. However, none of these teeth were used for fixed bridge abutments where the stress on the resected teeth would be greater and presumably cause a lower success rate.

Evidence for Implant-Supported Options

The current fixed alternatives to tooth-supported fixed partial dentures include using dental implants, either as free-standing single or multiple restorations, as bridges or connected to natural teeth. In a 10-year study, Parien and colleagues9 reported an 89 percent success rate for implants and an 82 percent success rate for prostheses in the posterior mandible. Fewer complications were seen in premolar than molar areas, and with cemented single crowns than screw-retained crowns.

Other, more recent studies of single-tooth restorations have reported success rates of 98 percent10 and 96 percent11 for external hex implants and 99 percent for internal tapered implants.12 In the later study of posterior restorations, failures were noted only in the mandibular molar area, and only 2 percent of the cemented restorations had any complications. In addition, 108 of the restored implants were in areas with multiple contiguous implants, with only one reported failure.

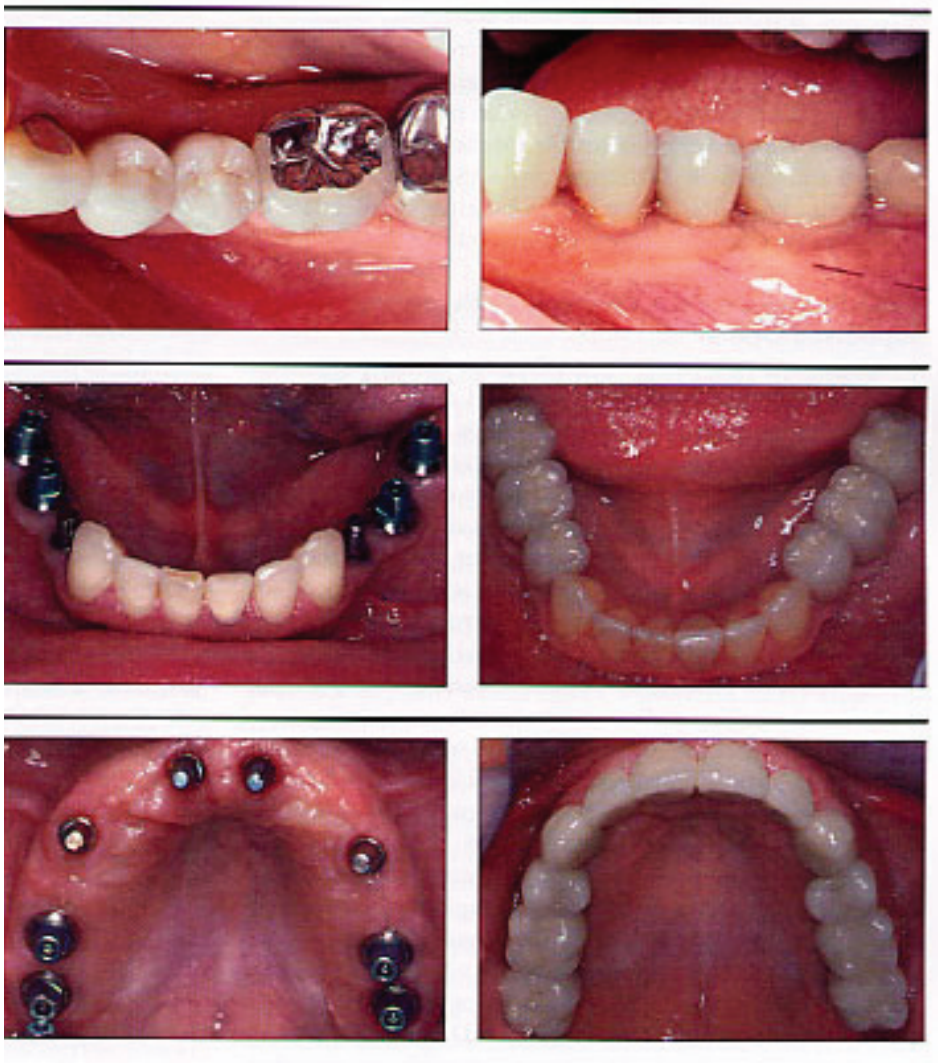
Additional studies report that fixed prosthetic restorations including a pontic on implants in partially edentulous patients also have high success rates: 97 percent in both a 12-year study13 and a 15-year study.14 Restorations where implants are joined to natural teeth have also been successful: 94 percent in a 15-year study14 and 90 percent in an eight-year study.15

Two studies evaluating freestanding implant fixed partial dentures against implant-tooth fixed partial dentures in the same patient show no significant differences in bridge retention.16,17 Implant loss (5 percent), periapical lesions (3.5 percent), tooth fracture (0.6 percent), and tooth extraction due to decay or periodontitis (1 percent) were reasons for tooth-implant prosthesis failure.18 This same study also noted tooth intrusion (3.4 percent) and crown cement failures (8 percent). Garcia and Oesterle19 described a survey where respondents reported a 3.5 percent occurrence of natural tooth intrusion. However, Fugazzotto and colleagues20 had only nine intrusion problems in 3,096 screw-fixed attachments. These tooth intrusions were all associated with fractured or lost screws, while Lindhe and colleagues reported 5 percent intrusion, which was all associated with nonrigid connections.21 Rigid connection did not appear to allow natural tooth intrusion to occur.21 A majority of the complications of tooth-implanted supported fixed partial dentures seemed to occur with the tooth abutments.

Biological Expenditure of Abutment Teeth

In addition to the clinical success and economic cost of alternative therapies, the biological harm of the treatment must be evaluated. Aquilino and colleagues22 looked at the 10-year survival of teeth adjacent to bounded edentulous spaces, edentulous areas with teeth on either side. Survival for patients treated with fixed partial dentures was 92 percent of the abutment teeth; for untreated spaces, 81 percent of the adjacent teeth; and for removable partial dentures, 56 percent of the bordering teeth.

In a parallel study, Preist23 restored implants placed in bounded edentulous spaces and looked at the survival of the adjoining teeth. Only a single tooth was lost (the fracture of an endodontically treated tooth), and one tooth was restored, resulting in 99.5 percent survival of adjacent teeth, with only 1 percent needing any treatment. The non-involvement of the boundary teeth



Figures 2a and b. Failure of double abutted bridge Nos. 18 x 21 x 22, with the loss of tooth No. 21 due to subosseous caries. The patient was restored by leaving a satisfactory abutment crown on tooth No. 18, fabricating individual implant crowns on implants Nos. 19, 20 and 21, and making a post-core and crown for endodontically treated tooth No. 22. Any complications would only concern a single tooth unit, rather than a complex fixed partial denture.

Figures 3a and b. Implants replace the mandibular posterior teeth providing posterior fixed support for the vertical dimension of occlusion.

Figures 4a and b. Although not the scenario in this patient's treatment, posterior implants replacing the molars could be augmented with additional anterior implants after the removal of the anterior teeth, creating a full-arch fixed implant restoration.

in the restoration seemed to have a most advantageous effect and would decrease the future liability of these teeth needing further care.

Fugazzotto reported that root-resected teeth appear to have comparable success rates compared to single implants.24 However, his reported success rates for the resected teeth were 10 percent greater than the studies previously cited. He also noted that most failures in both groups were in the terminal molar positions of the arch.

Currently, the replacement treatment for patient A.K. in the mandibular left edentulous area would probably be done with a single cylindrical implant restoration. This would enhance the prognosis of the distal hemisected molar and the full crown restoration anterior to the bounded edentulous space. A decision would need to be made on whether to replace hemisected No. 18 with an implant restoration at the time of initial treatment or later, at the time of its possible failure. Due to the precarious nature of terminal root-amputated teeth, this would probably be done as part of the initial therapy.

The choice of restoring individual units would have restricted any future needed treatment to the single affected tooth or implant. Also, it would have precluded the subsequent treatments that occurred with A.K. of the subperiosteal implant with double-abutted premolars, the root-form implant to tooth fixed partial dentures, and the cantilever splint with subsequent caries on the distal abutment, even though these treatments were the state-of-the-art at the time they were performed.

The mandibular right implant fixed partial denture would be a current treatment choice in light of the progressive bone loss on these posterior teeth. The

choice of the implant fixed partial dentures does not involve or compromise any of the remaining teeth in the arch.

Another current treatment alternative to consider for patient A.K. is maxillary bilateral sinus grafts and implant replacement of the maxillary molars before their subsequent loss to both attachment loss and caries. This would have conserved more alveolar bone, provided more stable posterior support and less trauma to the anterior teeth, and prevented the need for a maxillary removable prosthesis. This alternative is much easier to advocate 25 years after this patient's treatment inception.

Considerations for the Complete Arch Implant-Supported Option

Evaluation of a patient regarding the future progression of disease and the stability of proposed restorations at any single point in time is nearly impossible. A treatment decision that often needs to be made in patients with refractory periodontal disease and a high caries rate is when is it appropriate to extract all the remaining teeth and use the residual bone to fabricate a fixed full-arch implant restoration.

This future alternative can be anticipated with the placement of the implants in the partially edentulous patient and the use of these implants with additional fixtures to convert to the full-arch prosthesis. In a 15-year study of edentulous patient treated with mandibular fixed prostheses, 99 percent of the implants were successful and 100 percent of the prostheses were functional.25 A full-arch fixed prosthesis usually needs much fewer repairs and adjustments than a removable prosthesis.26

Comparing the available literature, even with its limitations, fixed implant restorations of a single tooth, freestanding or connected to teeth with fixed partial dentures, or a full-arch design have a very high success rate, and appear to be much more successful than natural-tooth-supported fixed partial dentures after a 15-year period. The implant restorations are more maintainable in patients with age- or pharmacologically induced xerostomia and geriatric reduced dexterity, because of the lack of caries and pulpal disease. The more frequent need for retreatment of the natural teeth could also counterbalance the possible greater initial financial cost of the implant restorations.

To enhance the prognosis, it is best to choose treatments that seem to have the best success. Regarding the choice of conventional versus implant fixed restorations, this information is now becoming available. The consideration of alternatives needs to take into account the optimal longevity, the probability the restoration will need additional care in the future, and the affect the current therapy may have on future needed treatment.

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Implant-Retained Removable Prosthetic Designs for Patients With Maxillary Posterior Edentulism

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When a patient has lost the maxillary posterior teeth, as patient "A.K." had, the problem has conventionally been resolved with a tooth-tissue supported removable partial denture. However, successful function with the prosthesis depends on the design of the remaining anterior teeth and their ability to provide anterior guidance.1 Generally, this can be achieved in the periodontal disease-resistant patient. Properly designed2 and maintained RPDs can provide long-term clinical service without detrimental effects on the periodontium, provided that preprosthetic periodontal health has been established.3 However, when the maxillary anterior sextant is periodontally compromised, treatment planning may be more complex.

With moderate anterior bone loss, the use of a fixed splint and a distal extension RPD, with or without attachments, has been successful.4 With the advent of a predictable endosseous implant system, placing posterior implants to support fixed partial dentures may be the treatment of choice. However, in the clinical scenario where there is a lack of alveolar bone height and/or width inferior to the maxillary antrum, sinus bone augmentations5 or onlay grafting6 may be essential for successful integration. Removable implant prostheses offer an alternative for patients who may have sinus complications, contraindications for extensive surgery, or time or financial limitations.

The bilateral placement of implants in the maxillary first premolar position as overdenture abutments for a distal extension RPD can provide auxiliary support and retention. Implant-retained attachments can eliminate direct retainers on the cuspids. Simplifying the framework design has been shown to reduce the periodontal indices on the cuspids,7 and may improve the survival rate of RPDs at 50 percent over 10 years.8 An additional implant placement in the molar region bilaterally can provide greater occlusal and extension base stability. With either

Figures 1. Intaglio view of overdenture superstructure.

Figures 2. Maxillary implant bar overdenture framework.

Figures 3. Maxillary implant milled-bar framework.

single-anchor attachments or bar-retained clips, an RPD overdenture with four posterior implants would mimic a posterior tooth-supported prosthesis.

With advanced bone loss in the anterior dentulous zone, accepted treatment plans would involve either an anterior fixed implant-supported splint with a posterior RPD9 or a bar-retained overdenture.10 In either case, a minimum of four implants is recommended. 11 The combination fixed and removable prosthetic design can also be fabricated with intracoronal or extracoronal attachments installed in the distal surfaces of the terminal abutments. The bar-retained overdenture can be designed with a round bar (Figure 1) or a milled bar (Figure 2), which offers the benefits of a fixed and removable prosthesis (Figure 3).12,13

Success rates of maxillary implant overdentures do not appear as high as mandibular implant overdentures.14 Inferior bone quality, adverse loading conditions, unfavorable crown-to-implant ratios and poor patient selection have been underscored as risk factors.15 Therefore, the following guidelines have been recommended: The implant length should be greater than or equal to 10 mm with an even distribution between first premolars.10 A standard diameter of 4.1 mm is suggested. Implants of a reduced diameter should be combined with a standard diameter.10 Alcoholics, drug abusers, bruxers, depressed patients, and heavy smokers (more than 10 cigarettes per day) should be excluded.16 When these criteria have been observed, cumulative survival rates of 90 percent over five years have been documented.17,18 A number of authors have reported higher incidence of complications with removable implant prostheses compared to fixed.19,20

However, Zitzmann and Marinello21 found no significant difference between fixed and removable implant reconstructions in the time until retreatment, a measure that may represent best the outcome of prosthetic success.

The use of solitary retentive anchors for the substructure design of the removable implant prosthesis on the maxillae remains controversial. A bar connection may offer cross support for varying bone densities found in the maxillae. However, studies have not been conclusive as to superiority of the bar compared to ball attachments.22

The milled-bar-retained removable prosthesis, often referred to as a spark erosion prosthesis, has a number of advantages.23 The interimplant distance does not depend upon on retaining clip space. Nonparallel implant alignment can be more easily reconciled with the mesostructure. The rigid-bar construction may thwart bending moments that may impact more flexible bar designs.24 The metal superstructure retards fracture with minimal bulk and extension onto the palatal region. The attachments offer retention security and allow removal for hygiene (Figure 4). Only an 8 to 10 mm interarch distance is required25 as opposed to 11-13 mm for the conventional overdenture design.26 The disadvantages of this design are technique-sensitivity and increased cost. Alternative milled-bar designs with reduced costs have been reported.27,28 No longitudinal studies have been published on the success rate of the maxillary milled-bar design.

The removable implant overdenture design may be the first-choice treatment for patients also considering a fixed implant alternative. In fact, it has been shown that this design on the maxillae can be accepted as an equally good treatment modality when patients' assessments are evaluated.29 Differential treatment planning for a fixed or removable implant prosthesis for patient A.K. or others include decisions regarding number and position of implants and type of prosthesis. A pyramid of objective and subjective factors (Figure 5) can be helpful to consider. Complete denture principles dictate lip support, dental-gingival esthetic needs, space allowance, and phonetic requirements.31 Limited bone quality and quantity may preclude a fixed restoration.32 Off-ridge relations may favor a removable prosthesis. When a patient is a bruxer, posterior implants may help to stabilize the increased forces.33 Subjec-

Figures 4. Superstructure for milled-bar framework (note retention latches on palatal aspect).

Figures 5. Pyramid of factors to be considered for successful treatment planning.

tive factors include patients' expectations about retention, timeline of treatment, hygiene access, and cost.

In conclusion, the increasing emphasis on evidence-based dentistry during the past 25 years has buttressed dentists' ability to predict treatment success over the long term. Decisions regarding fixed or removable designs, conventional or implant retained prosthesis, or having treatment at all have become more deliberate.

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Legends

CDA JOURNAL, VOL 31, Nº4

CDA JOURNAL, VOL 31, Nº4

The Evolution of Implant Therapy for the Edentulous Patient

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Few developments have had the positive effect on the clinical practice of dentistry that endosteal dental implant development has had. The scope of treatment that can be provided to a patient has been significantly broadened. Treatment plans once focused solely on the presence or absence of natural dentition. Therefore, traditional fixed or removable prosthodontics or combinations thereof were the only options. However, if overall patient satisfaction is assessed, the group of individuals with the highest propensity for a compromise in function, comfort, and/or self-esteem are the edentulous patients.1 The mandibular arch would often be the source of many post-treatment complications due to the nature of the anatomy of the area and the physiology of the bone.

The patient "A.K." presents today with stable anterior sextants. However, with her past history of periodontal disease and retreatment, it is conceivable that the future may require considerations for the loss of the remaining teeth. This article will focus on the cylindrical or root-form implant as related to the edentulous patient and the treatment of the mandibular arch.

A significant amount of information has been published on creating treatment modalities to improve the quality of life of the edentulous patient. Per-Ingvar Brånemark deservedly receives most of the credit for providing a predictable treatment protocol. The original protocol, as described by Brånemark and colleagues,2 required a two-stage surgical protocol: the surgical placement and surgical uncovering of an implant. The suggested healing period of three months for the mandible and six months for the maxilla was followed religiously. It was assumed that the healing period provided a time of nonfunction to ensure that osseointegration of the implants would occur. The restorative goal was usually the placement of a fixed implant-supported mandibular prosthesis, formerly referred to as a hybrid prosthesis. Many authors have published studies that duplicated and validated the use of this

treatment modality endorsed by the dental profession.3-6

Though clinically very successful, the criteria for success were challenged and research began for scientific evidence to support them. One of the issues being reviewed in recent years has been the need for the healing period following implant placement. Recent clinical and scientific reports describe a one-stage surgical protocol followed by the immediate utilization of the implants, particularly when treating the anterior mandible.7-10 The reported success showed a trend that could be comparable to the two-stage protocol. This pattern appears to be occurring for patients treated with fixed implant-supported mandibular prostheses or implant-retained mandibular overdentures.11,12 The advantages of immediately loading implants are that it allows for the immediate improvement in the patient's functional ability and self-confidence while dramatically reducing treatment time. Proper clinical assessment of bone density and implant stability becomes even more important when implants are immediately loaded since the usual period of healing (nonfunction) has been eliminated.

Clearly, the way in which dentists utilize dental implants is evolving. When patients present psychological, emotional, and anatomical concerns about the loss of the natural dentition or the wearing of removable prosthetic appliances, the concept of immediate loading of dental implants has the potential for being a viable addition to treatment modalities. Clinical judgment plays an even more critical role due to the subjective nature of the decision-making process when immediately loaded implants are concerned. Continued research in this area on combining surgery and prosthesis design will be critical for dentistry to be able to include immediate placement and immediate loading of osseointegrated implants into routine treatment planning.

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What Can We Offer Patients With Today's Advancements in Dental Materials?

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The dental materials and techniques used in the treatment of patient "A.K." 25 years ago have historical significance. The use of metal-ceramic restorations was the norm and considered state of the art. Since their introduction by Weinstein and colleagues in the early 1960s, porcelain-bonded-to-gold alloys have been a breakthrough in dental esthetics and porcelain restorations.1,2 This patient's treatment with metal-ceramic restorations was the evidence-based treatment of its day and the standard of care. It still is. As new techniques have evolved, many other restorative options have established a growing body of evidence of success.

All-ceramic restorations have evolved from the porcelain jacket crowns of the 1960s to the CAD/CAM restorations of today, using high-alumina-reinforced ceramics or zirconium-reinforced ceramics as cores instead of metal or gold. The first breakthrough in all-ceramic restorations, without a significant sacrifice of strength, is the In-Ceram restoration. In-Ceram is an infiltrated high-alumina core material. A diffusion of glass fills the spaces between the alumina particles creating a 72 percent concentration of alumina in the core, which is then veneered with feldspathic porcelain.2,3 A prospective clinical trial study shows the three-year survival rates of In-Ceram restorations to be 98 percent for anterior crowns and 94 percent for premolars or molars. The reasons for lost crowns were core fractures, porcelain fractures, and removal without failure.3

The difficulty with any of the high-alumina systems is control of shrinkage.2 In 1993, Andersson and Odén developed a manufacturing process to fabricate copings with a dense sintered high-purity alumina of 99.9 percent. The technique uses a contact scanner and a copy-milling machine to develop a 12 percent to 20 percent enlarged die of the tooth preparation. In a manufacturing center, high-alumina powder is compacted against the die, and the unsupported coping is sintered at 1,550 degrees Celsius for one hour, resulting in a

Figures 1. Internal aspect of a Procera Zirconium core crown.

Figures 2. Solid milled titanium framework, prior to metal finishing.

Figures 3. Procera implant bridge framework, prior to porcelain application.

highly dense sintered alumina coping that is the core for a Procera AllCeram crown.4 The coping is returned to the local dental laboratory for the technician to apply the porcelain veneer. A prospective multicenter study of 12 clinicians looked at the cumulative survival rates of these crowns over a period of five to 10 1/2 years. The survival results were 97.7 percent and 93.5 percent respectively, with a cumulative success rate of 97.7 percent.5 Their results were similar to other all-ceramic alumina core studies.

The later years of A.K.'s treatment show the placement of two dental implants restored with a metal-ceramic fixed partial denture. Studies have shown that this treatment requires a passive-fitting restoration to help prevent unstable or loose gold screws, implant fractures, and other mechanical complications.6,7 Creating a passive-fit implant prosthesis by the lost-wax technique has a wide range of variables, which starts with the fabrication of the impression, creating the master cast, making the casting, and soldering techniques, and ends with the application of porcelain.6,8 With the use of the computer numeric-controlled milling technique, it is possible to fabricate a solid one-piece titanium framework (Procera Implant Bridge) that is milled to shape instead of a cast-gold framework.9 This process eliminates the casting and soldering problems and the possible distortion after the firing of dental porcelain to the framework. Studies have compared the computer numeric-controlled-milled frameworks to conventional castings on master-cast replicas and found no significant differences. Therefore, the advantage of this technique is to eliminate the multiple problems with distortion inherent in the lost-wax casting technique, soldering, and dental porcelain application.10

As the years pass, there is an ever-increasing number of technological advances in dentistry, especially in materials. The use of all-ceramic restorations instead of metal-ceramic restorations is increasing, with new ceramic restorations on the horizon, such as zirconium copings. The longest studies, however, are only 10.5 years, whereas metal-ceramic restorations have been used since the late 1960s and have more than 25 years of treatment success, as seen with A.K. All these new techniques and materials have provided great advances in esthetics, precision, and time savings; but it will take time and research to develop evidence-based treatments for the predictable, successful restoration.

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The Evolution of Standard Precautions

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ABSTRACT Clinical applications of universal precautions are familiar to virtually every health care professional who provides dental, medical, or other patient care. This longstanding set of routine infection control precautions was developed in 1985 to prevent the transmission of hepatitis B virus, human immunodeficiency virus, hepatitis C virus, and other bloodborne pathogens during treatment procedures. In 1996, the CDC developed and published new guidelines for isolation precautions in hospitals. These were termed standard precautions. Standard precautions apply primarily to hospital settings; however the CDC is currently developing new infection control guidelines that apply specifically to dentistry.

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Clinical applications of universal precautions are familiar to virtually every health care professional who provides dental, medical, or other patient care. This longstanding set of routine infection control precautions was developed in 1985 to prevent the transmission of hepatitis B virus, human immunodeficiency virus, hepatitis C virus, and other bloodborne pathogens during treatment procedures. After the guidelines were published, dental professionals took special note of the statement that blood and other body fluids, including saliva, were considered potentially infectious for occupational pathogens.1

Although HBV had been clearly documented as being far more infectious than HIV in occupational health care settings, many people regarded the prevention of HIV transmission as the primary rationale for the introduction of universal precautions. This was evident in publications issued by the Centers for Disease Control and Prevention,2-4 as illustrated in the following excerpt:

"Universal precautions: Since medical history and examination cannot reliably identify all patients infected with HIV or other bloodborne pathogens, blood and other body-fluid precautions should be consistently used for all patients. This approach, previously recommended by CDC, and referred to as 'universal blood and body-fluid precautions' or 'universal precautions,' should be used in the care of all patients, especially in emergencies when the risk of blood exposure is increased and the infection status of the patient is usually unknown."3

The introduction and recommendation of universal precautions replaced the previous rules included in the 1983 publication, CDC Guidelines for Isolation Precautions in Hospitals.5 The primary purpose of universal precautions was to prevent infections transmitted via direct or indirect contact with infectious blood and other body fluids.

A key feature of the proposal was the empowering of hospital personnel to de-

termine the patient's category of infection risk. This was an improvement over earlier isolation-based infection control guidelines that were published in 1975.6 An extensive series of category-specific recommendations now required hospitals to decide whether to institute disease-specific isolation precautions or to develop unique isolation systems for their individual facilities. These isolation systems included:

* Blood and body fluids precautions;
* Strict isolation;
* Contact isolation;
* Respiratory isolation;
* Tuberculosis isolation;
* Enteric precautions; and
* Drainage/secretion precautions.

Because many health care workers were especially concerned with occupational blood exposure and HIV risks, the introduction of universal precautions began to overshadow isolation precautions. Although the adoption and routine use of universal precautions proved effective in minimizing the potential for transmission of HBV, HIV, and HCV the practices did not eliminate the need to implement category or disease-specific isolation precautions for nonbloodborne infections in medical facilities.

In 1987, the CDC introduced a body substance isolation system that focused on reducing the transmission of infectious material from any moist body substance.7,8 Body substance isolation systems were designed to address isolation procedures of all moist, potentially infectious body substances, regardless of their presumed infection status. The body substances covered by this system included blood, feces, urine, sputum, saliva, and wound exudates. The distinguishing feature of these systems was the recommendation that health care workers wear gloves when anticipating contact with blood, secretions, mucous membranes, nonintact skin, and moist body substances during treatment of all patients. The CDC also recommended immunization for health care professionals against selected infectious diseases (i.e., measles, mumps, rubella, varicella) transmitted by airborne or droplets modalities, as well as the wearing of appropriate barriers, such as gowns.

In Garner's 1996 review and proposal for current infection and control precautions in hospitals, she summarized both the successes and controversial elements of the 1987 body substance isolation system.9 Central to the subsequent development of the combined system, which incorporated the best protective elements of universal precautions and the body substance isolation programs, was the recognition that: 1) health care workers were confused about universal precautions and body substance isolation; 2) body substance isolation did not cover all of the necessary precautions necessary to prevent transmission, including droplet transmission of certain bacterial agents in children; and direct or indirect contact cross-infection of important nosocomial pathogens (i.e., Clostridium difficile and vancomycin-resistant enterococci).9,10

In recognition of these concerns, in 1996 the CDC developed and published new guidelines for isolation precautions in hospitals. These were termed standard precautions. They incorporated the major features of universal precautions and BSI11 (Table 1). Standard precautions apply primarily to hospital settings; however the CDC is currently developing new infection control guidelines that apply specifically to dentistry. The CDC infection control guidelines published in 199811 are already similar in many areas to current dental recommendations for infection control.

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Table 1. Standard Precautions

Standard precautions combine major features of universal precautions and body substance isolation precautions into a single set of recommendations.

Standard precautions
* Are designed to reduce the risk of transmission of pathogens, from both recognized and unrecognized infection sources, to patients and health care professionals.
* Apply to blood, all body fluids, secretions and excretions (except perspiration), nonintact skin, and mucous membranes.
* Should be used in the care of all patients, regardless of infection status.
* Include precautions based on transmission routes: airborne, droplet, or contact.
* Describe specific syndromes highly suspicious for infection.
* Identify appropriate transmission-based precautions until diagnosis can be made.

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Anxiety Management

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A recent issue of Time was devoted to understanding anxiety, citing the 9/11 disaster as an exacerbating factor in correctly labeling us as a nation of anxious worriers. "We live in a particularly anxious age," Time says, noting that all animals appear to feel anxious, that being Nature's way of preventing us from feeling too safe. If true, then animals have handled their concerns with more aplomb than we have.

Take dogs for example. Dogs have only two anxieties: when their next meal is scheduled and whether their mouth or back paw is the best tool to get at that place that itches. A human will worry about whether the meal is nutritionally sound, low in calories and free of the botulism and trichinosis that could land him in the ICU. This amount of worrying is way beyond what his medical insurance will pay for, plus it will boost his cholesterol completely off the scale. Feeling "too safe" is something he's never known.

You never hear anything about Father Nature. No, it was Mother Nature who decreed that women would be genetically superior as worriers, thus ensuring the species would endure rather than be left to males who, if they worry at all, do so about the wrong things. If this seems a bit sexist, remember Mother Nature knows best. Males, to their credit, have graciously acceded worry rights to women in all categories except sports and internal combustion engines. It is no coincidence that dogs have been called "man's best friend." They are so much like their masters.

Having said that, it is necessary to point out that anxiety can be a useful tool in focusing the mind on potential dangers. It requires a great deal of inexperience to be beyond the reach of anxiety. What is important is to distinguish clinical anxiety disorder from just run-of-the-mill fretting. Let us examine some of the manifestations:

* Panic disorder – An attack of acute anxiety such as discovering a major case scheduled for delivery in 15 minutes won't be back from the lab until day after tomorrow. Four or more of these episodes in a single week could mean Big Trouble.

* Specific phobia – We all have these, broccoli for example. If a certain name on the appointment book causes elaborate ways to be devised to avoid the encounter, the key is how the anxiety is handled. Cancellation is found to be effective.

* Obsessive-compulsive disorder – Never in recorded history have dentists been more anxious about bacteria, cross-contamination, biofilm and barrier techniques. If the anxiety is temporarily relieved by a repetitive hand-washing ritual or a thought ritual such as praying, it may respond to treatment. Probably this is not a covered benefit.

* Post-traumatic stress disorder – Defined as a repeated, anxious reliving of a horrifying event over an extended period. Typically, an eight-unit bridge won't seat because you took a lousy impression, one of the spindly abutments fractured at the gum line, and both the lab and the patient have consulted attorneys and written letters to the Dental Board. Advice: Seek help whenever the symptoms occur.

* Generalized anxiety disorder – Characterized by excessive anxiety or worry that occurs more days than not for periods of 20 years or more. Inasmuch as most dentists experience this as irritability, fatigue and muscle tension, it comes under the heading of No Big Deal, or Goes With the Territory. Golf is said to be a diversion, but not a treatment modality.

Dentists, male or female, have evolved into world-class worriers since their early days in dental school. All the recent attention being paid to the rest of the population catching up serves only to call attention to some anxieties veteran dental worriers may have overlooked. Consider these:

* If you have ever placed even one amalgam restoration in your career, be aware that you knowingly placed a compound containing a toxic substance, namely mercury, into a patient's personal body, probably without a signed waiver. You are thus subject to anxieties you never imagined, the worst being having to hear about it interminably from phobic antagonists.

* Resin restorations almost certainly have something toxic in them. Just because the components taste bad doesn't necessarily mean they are good for you. The fatal element just hasn't been discovered yet, but you can bet they're working on it.

* As a general practitioner, you should have noticed by now that all the specialists you refer to have a more opulent lifestyle than you, take more time out of their offices than you, and indulge themselves with vacations costing more than your annual net. It would be wrong for you to sleep soundly knowing that on average they are 10 years younger than you.

* The computer you have in your office confirms that you're really asking for it. When you least expect it, an asteroid no bigger than a school bus, but with a magnetic field larger than Jupiter's is going to pass within 20 miles of your office and put you out of business. It happens all the time.

* You'd be better off with a tarantula in your undies than having three unattended kids under 5 on sugar highs left in your reception room with Crayolas and All-Day Gob Stoppers.

* If your curing light is powerful enough to turn something soft into something hard as a bowling ball in 20 seconds, what else can it do?

* Patients who are gaggers and allergic to antibiotics and every pain killer known to be effective, will make a bee line for your practice the second they are in trouble --usually about 4:30.

* Evidence-based dentistry looms on the horizon. This means dentists may be forced to provide evidence that they are proficient in terms of placing at least one Class III gold foil each year on their birthday and correctly reciting the enervation of every major organ of a dead frog.

If your job or the place you live is making you anxious, Time concludes, you might consider moving to a less stressful environment or finding a different line of work. It is reported that there are entry-level opportunities now available in airport security and various SWAT teams about the country.