COVER STORY

Evidence-Based Periodontal Treatment

HIGHLIGHTS FROM THE 1996 WORLD WORKSHOP IN PERIODONTICS

ABSTRACT

State-of-the-art periodontal therapy involves a wide range of diagnostic and treatment options. The 1996 World Workshop in Periodontics used an evidence-based approach to assess the efficacy of many of these options. This article describes the evidence-based approach and summarizes the findings of the workshop in the areas of diagnosis and nonsurgical and surgical periodontal therapy as well as dental implants.

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How does a clinician decide if a particular treatment or diagnostic test is efficacious? Since 1966, the American Academy of Periodontology has conducted conferences on the state of the art in clinical periodontics. World Workshops in Clinical Periodontics have been held in 1966, 1977, 1989 and 1996. The purpose of this article is to summarize for the clinician some of the salient findings of the 1996 World Workshop in Periodontics.

EVIDENCE-BASED APPROACH

The 1996 world workshop was unique in that it adopted an evidence-based approach to the difficult problem of deciding when particular treatments or diagnostic methods work. In clinical practice, a clinician must weigh a myriad of evidence every day. That evidence ranges from personal experience and case reports to controlled clinical trials. Traditionally, most clinical decisions in dentistry have been based on the experience of the clinician. If a treatment seems to work, it is administered again; if the results are disappointing, the procedure may be abandoned. Therapies tested in this fashion are often unpredictable because the clinician may not know which factors are important for success and which factors contribute to failure.

The evidence-based approach strives to strengthen clinical experience through the systematic evaluation of available information, which allows the clinician and patient to benefit from the amassed data. In an evidence-based approach, all evidence is not given the same weight.[1] The stronger the evidence, the stronger the recom-

TABLE 1

CONSENSUS FINDINGS: DIAGNOSIS OF PERIODONTITIS.

TEST	APPLICATION	STRENGTHS	WEAKNESSES
Periodontal screening and recording	All patients in every practice	Cost-effective, quick, easy, detects patients with periodontal disease	Does not provide a tooth-by-tooth assessment for later comparison during maintenance therapy; a full periodontal examination is needed for this purpose
Probing pocket depths	All patients	Shallow probing depths associated with a lack of future disease progression	Moderate-to-deep pockets in a single probing depth examination will not distinguish with certainty which teeth will undergo progressive periodontal destruction
Gingival inflammation assessment	All patients	Absence of inflammation is associated with a lack of future disease progression; in treated patients, bleeding on probing is associated with an increased risk of progressive loss of attachment	Presence of inflammation will not distinguish with certainty which teeth will undergo progressive periodontal destruction
Radiographic evidence of bone loss	At-risk patients as determined by PSR screening or periodontal examination	Absence of bone loss is associated with a lower risk of future disease progression	Presence of bone loss on a single radiograph will not distinguish with certainty which teeth will undergo progressive periodontal destruction
Microbial plaque tests	High-risk or refractory patients	Absence of supragingival plaque is associated with a lack of disease progression	Routine testing offers limited benefit in adult periodontitis
		In compromised or refractory patients, may be useful in determining the presence of pathogens	
Biochemical profiles in gingival crevicular fluid	Not yet determined	A number of biochemical markers may identify individuals at risk	At present, there are no specific biochemical profiles that characterize specific periodontal diseases

mendation it will support.

While all clinicians form opinions, an evidence-based approach puts the most weight on reports that have clearly defined goals, that objectively measure both risks and benefits of a treatment, that acknowledge potential sources of bias in the study design, and that use analytic methods to determine both statistical and clinical significance. Evidence is ranked in the following manner.

The double-blind, placebo-controlled clinical trial is generally regarded as being at the top of the hierarchy of evidence. This type of trial randomly assigns patients to various treatments or placebo, and neither the patient nor the investigator knows who received which therapy, thereby reducing potential bias. Of course, not all clinical questions are amenable to this study design because of ethical considerations or the fact that patients may be aware of the type of treatment rendered (such as in a study comparing root planing with surgical treatment). This type of trial is often referred to as a randomized controlled trial.

Other types of studies follow patients in a randomized protocol that compares treatment with no treatment. It is important to remember that no treatment is not the same as placebo treatment. Because the patient

TYPE OF EVIDENCE
Epidemiologic studies
Longitudinal studies
Longitudinal studies
Longitudinal studies
Cross-sectional and longitudinal studies
Case reports
Cross-sectional and longitudinal studies

is well aware that no treatment has been rendered, this knowledge may affect patient-administered home care, such as brushing and flossing, thereby influencing plaque control and compliance. Furthermore, if the clinician is aware of which treatment has been administered, his or her objectivity in evaluating the results may be reduced.

Longitudinal studies, which follow groups of patients or large cohorts in epidemiologic studies, can provide important information about the long-term effects of treatment or the natural history of a disease. If such studies are conducted without suitable controls, however, potential bias in evaluating the results may occur.

Cross-sectional studies compare groups of subjects—for example, patients treated with different modes of therapy—at a single point in time. While such studies are relatively quick and simple to conduct, they do not give the clinician information regarding the effect of treatment over time.

Case reports provide early information about new clinical techniques, often with detailed methods. Case reports are not designed to provide an unbiased estimate of treatment efficacy.

Animal and laboratory studies provide important information that can be used to improve the design of human clinical trials.

As clinicians, we must be able to recognize the different levels of evidence because they allow us to assess the value of the information provided. The evidence-based approach helps to ensure that efficacious treatments are used in practice.

As clinicians, we must be able to recognize the different levels of evidence because they allow us to assess the value of the information provided. The evidence-based approach helps to ensure that efficacious treatments are used in practice. This approach does not ignore the patient and concentrate solely on numbers and statistics. To the contrary, the evidence-based approach recognizes the importance of patient preference and quality-of-life issues.

IDENTIFYING THE EVIDENCE

Before the meeting, reviewers who were internationally known experts in the field were given the daunting task of summarizing the literature in the field of periodontitis, with emphasis on material published since the last world workshop in 1989. Each paper received an exhaustive peer review. One common aspect of each review was the use of evidence tables that presented the important findings of pertinent literature. A typical evidence table included, in addition to authors' names and summary results, strengths and weaknesses of the study and the type of evidence provided (from randomized, double-blind, controlled clinical trials to case reports). Extensive bibliographies were also included.

Topics addressed included surgical and nonsurgical therapy, implant therapy, diagnosis and epidemiology of periodontal diseases. The workshop also addressed medically compromised patients, older adults, mucocutaneous disorders, anxiety and the pathogenesis of periodontal diseases. Consensus on each topic was reached in group

TABLE 2

CONSENSUS FINDINGS: NONSURGICAL TREATMENT OF GINGIVITIS AND PERIODONTITIS.

TREATMENT CATEGORY	TREATMENT	STRENGTHS	WEAKNESSES
Professional mechanical therapy—used in the treatment of gingivitis and periodontitis	Scaling and root planing with manual instrument	Decreases gingival inflammation by 40% to 60%; decreases probing depth; facilitates gain in clinical attachment level	Requires attention to detail
	Ultrasonic and sonic scaling and root planing	Results are similar to those for manual scaling and root planing	
Chemical plaque control with mouthrinses and toothpastes	Chlorhexidine; triclosan with copolymer or triclosan with zinc citrate; essential oils; stannous fluoride	Significant reduction in gingival inflammation	No clear evidence that there is a substantial long-term benefit in periodontitis except to control coexisting inflammation
Irrigation	Supragingival and subgingival irrigation used as an adjunct to brushing	Aids in the reduction of gingivitis	No clear evidence that there is a substantial long-term benefit for periodontitis
Sustained-release antimicrobials	Intrapocket resorbable or nonresorbable delivery systems containing a tetracycline antibiotic	When used as an adjunct to scaling and root planing, gains in clinical attachment level and decreases in probing depth and bleeding	A few reported side effects include transient discomfort, erythema, recession, allergy and, rarely, *Candida*
Systemic antibiotics	Tetracyclines, metronidazole, spiramycin, clindamycin and combinations such as metronidazole and amoxicillin	May be useful to treat aggressive, destructive periodontitis	Not indicated for gingivitis; not indicated for most adult patients with periodontitis

meetings, and all participants in the world workshop had the opportunity to review and critique the consensus reports before they were finalized.

Each working group was charged with answering specific, pertinent questions based on the published evidence. All types of published evidence were considered, but were weighed in accordance with the descriptions above. The consensus findings in the areas of diagnosis, nonsurgical therapy and surgical therapy are summarized in Tables 1 through 3. This workshop and its published proceedings represent the most comprehensive consensus review to date on clinical periodontics.[2]

DIAGNOSING PERIODONTAL DISEASES

The world workshop considered both routine clinical diagnostic methods, such as clinical examination and radiographs, as well as methods of detecting bacterial pathogens or assessing biochemical markers in the gingival crevicular fluid. Some of the major findings are summarized below.

Periodontal screening and recording examination. The PSR provides the dentist with a cost-effective and simple method of screening patients for periodontal diseases.[3] Because the PSR does not provide a tooth-by-tooth assessment of probing depth, a full periodontal examination is needed for a complete diagnosis of patients found to be at high risk, based on the screening examination. The PSR usually takes 2 to 3 minutes to perform and simply requires that the examiner record the worst score in a sextant.

The workshop clearly reached consensus that all patients in every practice should

TYPE OF EVIDENCE
Many longitudinal, cohort and randomized clinical trials
Longitudinal, cohort and randomized clinical trials
Randomized, double-blind clinical trials
Randomized, double-blind clinical trials
Randomized, double-blind clinical trials
Assessment of risk-benefit ratio; randomized, double-blind clinical trials; longitudinal assessment of patients' conditions

be screened for periodontal disease.[4] A complete description of the PSR is provided in the Periodontal Screening and Recording System training manual (1992) sponsored by the American Academy of Periodontology and the American Dental Association.

Probing depths. These are an integral part of the PSR examination as well as any complete periodontal examination. Longitudinal studies have shown that shallow probing depths are associated with lack of disease progression. It is interesting to note, however, that the mere presence of a pocket does not herald progressive periodontitis in that site. While teeth with moderate-to-deep probing depths are at higher risk of additional destruction, a single examination cannot determine with certainty which specific teeth will undergo destruction.[3,4] Because of this limitation, longitudinal record keeping and frequent reevaluations are essential in monitoring disease progression.

Bleeding on probing and indexes. The clinician may assess gingival inflammation using a variety of methods, including bleeding on probing and indexes, such as the gingival index, to grade redness and bleeding. In adult periodontitis, the absence of inflammation is associated with a lack of disease progression; however, the presence of inflammation does not ensure that a given tooth will undergo further destruction. Longitudinal studies of treated patients in maintenance programs show that gingival bleeding, especially at several sequential recall visits, was associated with an increased risk of progressive loss of attachment. Therefore, it is essential to monitor patients frequently at recall visits.[3,4]

Radiographs are obtained for patients at risk of periodontitis, as determined by the PSR or periodontal examination. Bone loss at a single examination represents the amount of bone surrounding a tooth at a given time and reflects both the healing and disease that have occurred over a patient's lifetime. As was the case with probing depth, the mere presence of bone loss on a radiograph does not translate on a tooth-by-tooth basis to further osseous destruction, but it does increase the patient's risk of future bone loss.[3,4]

Bacterial testing. Many reports have focused on the potential of bacterial testing to identify patients at risk of developing connective-tissue and osseous destruction. The lack of gross plaque deposits is associated with a lack of disease progression (a clean mouth is a healthy mouth). However, a multitude of cross-sectional and longitudinal studies did not, for the most part, demonstrate a benefit from bacterial testing in common forms of adult periodontitis. This was true regardless of the method used to detect the bacteria (that is, culture, DNA probes or immunoassays).

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Therefore, the world workshop consensus report did not recommend routine bacterial testing for adult periodontitis at this time. It is important to recognize that this finding is based on the 1996 evidence. As tests and our knowledge of the pathogenesis of periodontitis improve, the benefit of new tests will continue to evolve. Bacterial tests may eventually be routinely beneficial to patients and practitioners.[3,4]

Case reports, however, have pointed to the usefulness of bac-

TABLE 3

CONSENSUS FINDINGS: SURGICAL PERIODONTAL THERAPY—SELECTED PROCEDURES.

CATEGORY AND GOAL	TREATMENT	STRENGTHS
Pocket therapy provides access to root surfaces and bony defects, reduces probing depths, facilitates plaque control and enhances restorative and cosmetic dentistry	Modified Widman flap to provide access to roots and bony defects for débridement; apically repositioned flap with or without bony recontouring; gingivectomy	All procedures decrease pocket depth; with the exception of gingivectomy, all increase clinical attachment level; after 5 years, greatest reduction in probing depth with osseous recontouring; apically repositioned flap with or without bony recontouring used in crown-lengthening procedures to provide biologic width
Regenerative procedures to facilitate growth of new periodontal ligament, cementum and bone over previously diseased root surfaces	Extraoral autogenous bone grafts	High potential for bone growth
	Intraoral autogenous grafts (such as maxillary tuberosity, healing extraction sites, osseous coagulum)	Case reports indicate bone gain of more than 50%; controlled studies comparing grafts with nongrafted bone show improved clinical attachment levels and bone, but not as great as those in case reports
	Allografts—tissue transferred from one person to another; freeze-dried bone allograft	Bone fill has been reported in a high proportion of defects involving freeze-dried bone allograft
	Alloplasts—synthetic grafts — absorbable: plaster, calcium carbonates, ceramics such as tricalcium phosphate and absorbable hydroxyapatite (HA) — nonabsorbable: dense HA, porous HA, bioglass — calcium-coated polymer polymethylmethacrylate and hydroxymethylmethacrylate	Improved probing depth and attachment level Some evidence of histologic regeneration in calcium-coated polymer polymethylmethacrylate and hydroxymethylmethacrylate
Guided tissue regeneration—physical barriers are used to facilitate selective cell population of the root surface after periodontal surgery to promote regeneration	Nonresorbable membranes	Significant improvement in clinical attachment level compared with débridement alone; most favorable results are in Class II furcations in the mandible and infrabony defects; no need for second-stage surgery (resorbable only)
	Resorbable materials	
Gingival augmentation to promote root coverage	Pedicle grafts Free soft-tissue grafts (epithelialized or connective-tissue graft) Combination grafts — connective tissue or biodegradable membrane barrier plus pedicle graft — coronally positioned, previously placed soft-tissue graft — nonbiodegradable membrane barrier plus pedicle graft	Improve esthetics/cosmetic results; decrease root sensitivity; manage defects resulting from root caries removal or cervical abrasion; manage mucogingival defects
Endosseous dental implants	Two-stage and one-stage implants; titanium; titanium alloy; hydroxyapatite-coated implants	Dental implants are predictable replacements for missing teeth in fully and partially edentulous patients

	WEAKNESSES	TYPE OF EVIDENCE
	Procedures designed to reduce probing depths may increase recession; lack of professional maintenance and patient compliance can be detrimental to the long-term success	Randomized clinical trials; longitudinal studies
	Second surgical site (such as iliac crest); root resorption may be associated with fresh grafts	Limited case report data
		Case reports; comparative controlled clinical studies
	Osteogenic potential may vary from vial to vial; patient differences; clinician variability	Field test; controlled clinical trials
	Histologic findings indicate that synthetic grafts primarily act as fillers, with little if any regeneration	Controlled clinical trials
	Less favorable results in maxillary molar and Class III defects; nonresorbable membrane requires a second surgery to remove the membrane	Randomized, controlled clinical trials; uncontrolled studies; and case reports
	Clinical results similar to those for nonresorbable membranes but less evidence available to allow a comparison of predictability with respect to nonresorbable membranes	
		Case reports; comparison studies
	While there are few studies in the literature, the clinician should use caution in the following cases: smoking, untreated periodontal disease, poor oral hygiene, uncontrolled systemic disease, history of radiation therapy, active skeletal growth	Longitudinal studies

terial and antibiotic sensitivity testing in special patient populations. These populations would include, but not be limited to, patients who are refractory to other periodontal treatment, patients with rapidly progressive periodontitis or early-onset periodontitis and certain medically compromised patients.[3,4]

The recent literature contains many cross-sectional and longitudinal studies of biochemical markers in gingival crevicular fluid. Crevicular fluid may be easily collected by inserting a filter paper strip into a pocket. The crevicular fluid is analyzed for biochemical markers associated with inflammation, tissue injury or tissue death. While these studies may offer promise for identifying individual patients at risk, there are no specific biochemical profiles that, based on the evidence available in 1996, characterize specific periodontal diseases or indicate a treatment recommendation based on the results of the tests.[3,4]

Consensus: diagnosis. Although advances are being made in many areas, current evidence shows that clinical signs of inflammation, clinical attachment level, probing depth and radiographic imaging remain the principal tools for making decisions regarding diagnosis and treatment of periodontitis.

NONSURGICAL PERIODONTAL THERAPY

Nonsurgical periodontal therapy includes both mechanical and chemotherapeutic methods of controlling plaque and reducing inflammation. The benefits of mechanical instrumentation (that is, scaling and root plan-

ing) have been demonstrated in a myriad of longitudinal, cohort and randomized clinical trials. Demonstrated benefits of scaling and root planing include decreased gingival inflammation, decreased probing depth and maintenance of clinical attachment level. The evidence indicates that similar results may be obtained with ultrasonic and sonic instruments and manual instruments. Regardless of the methods used, meticulous attention to detail is required to achieve optimal results.[5,6]

Chemical plaque control and gingival inflammation. Chemical plaque control has become an important part of the clinician's armamentarium. Significant reductions in gingival inflammation have been demonstrated for chlorhexidine; triclosan with copolymer or triclosan with zinc citrate; essential oils; and stannous fluoride. The magnitude of gingival inflammation reduction was greatest for chlorhexidine.[6-9] The evidence supporting these results comes from multiple, randomized, double-blind, controlled clinical trials. The evidence available in 1996 was also clear on another point: these antiplaque and/or antigingivitis agents do not offer a substantial benefit for the treatment of periodontitis.[6,9] They may, however, contribute to the control of gingival inflammation that exists with periodontitis.

Supragingival irrigation may be used as an adjunct to toothbrushing and has been shown to aid in the reduction of gingival inflammation. Even when subgingival irrigation is used, however, the evidence shows that there are no clear substantial long-term benefits for the treatment of periodontitis.[6,9]

Most evidence from well controlled randomized, blinded clinical trials indicates that systemic antibiotics do not offer sufficient benefit to overcome risks such as drug sensitivity and emergence of antibiotic-resistant pathogens for the routine treatment of common forms of adult periodontitis.

Antibiotic therapy and periodontics. Researchers have extensively studied the systemic administration of antibiotics including tetracyclines, metronidazole, spiramycin, clindamycin and others.[8] The risk-benefit ratio indicates that systemic antibiotics should not be used for the treatment of gingivitis.[6] When adult periodontitis is considered, the evidence is based on randomized, double-blind, controlled clinical trials. While the conclusions of individual trials may differ, the preponderance of evidence from well-controlled, randomized, blinded clinical trials indicates that systemic antibiotics do not offer sufficient benefit to overcome risks such as drug sensitivity and emergence of antibiotic-resistant pathogens for the routine treatment of common forms of adult periodontitis.[6,8]

However, the situation differs for aggressive forms of periodontitis, such as rapidly progressive or refractory periodontitis. Only a small proportion of patients (estimated to be less than 10 percent of people with periodontal disease) are affected by these forms of periodontitis. Randomized, double-blind, clinical trials, as well as longitudinal assessments of patients, indicate that systemic antibiotics may be useful in slowing disease progression.[6,8]

Local delivery of antimicrobial agents. In recent years, there has been considerable interest in the application of antimicrobial agents directly in the pocket, thereby eliminating or reducing many of the adverse side effects associated with systemic antibiotics. In randomized, double-blind, controlled, clinical trials, researchers have studied both resorbable and nonresorbable intrapocket delivery systems containing antimicrobials.[6,8] When these systems were used as an adjunct to scaling and root planing, modest gains in clinical attachment level and decreases in probing depth and gingival bleeding were demonstrated. A few side effects were reported, including transient discomfort, erythema, recession, allergy and, rarely, *Candida* infection.

Consensus: nonsurgical periodontal therapy. Based on the evidence discussed above, incorporation of systemic antibiotic therapy into the routine management of most cases of adult periodontitis is not justified at this time. Chemical plaque control agents, applied topically or by irrigation, may be useful in controlling gingival inflammation, but are not of

substantial benefit in the treatment of periodontitis. Locally delivered antimicrobial agents may be useful on a short-term basis when combined with mechanical therapy. Scaling and root planing accompanied by oral hygiene procedures remains the first mode of treatment for adult periodontitis. After adequate time has passed to evaluate the healing response, clinicians must re-evaluate patients' conditions to determine if further mechanical, adjunctive, pharmacological and/or surgical treatment is indicated.

SURGICAL PERIODONTAL THERAPY

Surgical pocket therapy. The armamentarium of surgical periodontal therapy is composed of techniques to provide access to root surfaces and bone defects for débridement and root planing, facilitate regeneration, augment the gingiva, promote root coverage and place dental implants. Traditional pocket therapy provides access to root surfaces and bony defects for débridement by the clinician. The overall goal is to make plaque control easier for the patient to perform and to enhance restorative cosmetic dentistry.[10] Many surgical techniques are available, including gingivectomy, the apically positioned flap (with or without osseous contouring) and the modified Widman flap (or access-type flap).

Extensive randomized clinical trials and longitudinal studies have demonstrated the efficacy of these procedures.[10] All procedures decrease pocket depth and, with the exception of gingivectomy, increase clinical attachment level. The evidence from long-term studies that followed up patients for 5 years after surgery indicates that the greatest reduction in probing depth was achieved when an apically repositioned flap was combined with osseous recontouring.[10]

The clinician should note, however, that procedures designed to reduce probing depth may increase recession, with concomitant root sensitivity and possible compromise of esthetics. Thus, selection of a particular surgical procedure must always be based on the particular needs of the patient.[10,11] Regardless of the approach selected, maintenance (including regular recall visits, periodontal prophylaxis and oral hygiene instruction) is important to long-term success.

Periodontal regeneration. Periodontal regeneration procedures are designed to facilitate growth of new periodontal ligament, cementum and alveolar bone over previously diseased root surfaces. The world workshop considered a wide variety of regenerative techniques, including bone grafts and guided tissue regeneration.

Bone grafts. Bone grafting techniques involve the use of natural bone or synthetic bone materials.[12] Natural bone grafts consist of autografts (bone transferred from one position in the body to another position in the same patient), allografts (tissue transferred from one person to another) and xenografts (tissue transferred from one species to another). Limited case report evidence shows that extraoral autogenous bone, such as hip grafts, offer high potential for bone growth.[12] Extraoral sites are associated with the need for a second surgical site and, in some cases, fresh grafts may be associated with root resorption.

Intraoral autogenous grafts eliminate the need for extraoral surgical sites. Sources of intraoral autogenous graft bone include, but are not limited to, the maxillary tuberosity, healing extraction sites and osseous coagulum. Evidence from case reports indicates that bone fill exceeding 50 percent of the osseous defect may be achieved. Interestingly, controlled studies comparing grafted with nongrafted sites also show significant improvements in clinical attachment levels and bone gain, but the magnitude of gain is less than that exhibited in the case reports.[12,13]

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Freeze-dried demineralized bone is one of the most frequently used and well-studied bone-graft materials in periodontics. Freeze-dried demineralized bone is an allograft material, meaning that it is harvested from one person, prepared and demineralized before being grafted to another person. The demineralization step is impor-

tant for the activity of morphogenetic proteins, which appear to be responsible for the bone-forming, or osteoinductive, qualities of the graft material.

Case reports and controlled clinical trials have demonstrated the bone-forming potential of this graft material. Bony fill has been reported to occur in a high proportion of sites.[12] However, the evidence does indicate some variability in the predictability and amount of bone fill achieved. This may occur because the osteogenic potential of the donor bone may vary, resulting in different osteogenic potential from different vials of graft material. Variability may also result from patient and clinician differences.

While less evidence is available for resorbable membranes than for nonresorbable membranes, significant improvements in clinical attachment levels have been shown for both types of membranes compared with débridement alone.

Since allografts are transferred from one person to another, the tissue bank should ensure proper handling and testing to minimize the possibility of transferring viruses or other pathogens to the patient.[12,13] Such procedures should include polymerase chain reaction testing for HIV. As of 1996, there were no reports of HIV transmittal in freeze-dried demineralized bone.

Table 3 lists a wide variety of synthetic graft materials used in alloplasts. These grafts may be absorbed by the patient over time or not be absorbed. Controlled clinical trials have demonstrated improvements in probing depth and attachment level with the use of synthetic grafts.[12,13] Histologic findings, however, indicate that in general, synthetic grafts act primarily as space fillers, with little if any regeneration. However, some histologic evidence of regeneration has been demonstrated with the synthetic material composed of calcium-coated polymer, polymethylmethacrylate and hydroxymethylmethacrylate.[12,13]

Guided tissue regeneration. Guided tissue regeneration procedures use physical barriers or membranes to facilitate selective population of the root surface by cells capable of forming new tissue. During the healing period after periodontal surgery, the cells of both the periodontal ligament and the pocket epithelium migrate along the root surface. If the epithelial cells migrate apically along the root surface, healing may occur with either a long junctional epithelium or a residual periodontal pocket without significant regeneration of connective tissue or bone. The goal of the membrane is to exclude the epithelial cells from the root surface while maintaining a space into which the periodontal ligament cells can grow. The ideal result is regeneration.

Investigators have studied both resorbable and nonresorbable membranes. Resorbable membranes do not require a second surgical procedure to remove the membrane approximately 6 weeks after the procedure. The sources of evidence demonstrating the efficacy of guided tissue regeneration range from randomized, controlled clinical trials to case reports.[13] While less evidence is available for resorbable membranes than for nonresorbable membranes, significant improvements in clinical attachment levels have been shown for both types of membranes compared with débridement alone. Most favorable results are reported for Class II furcations in the mandible and for intrabony defects. Less favorable results have been reported in maxillary molar and Class III (through and through) furcation defects.[12,13]

Mucogingival procedures include procedures to enhance keratinized tissue, cover exposed roots and eliminate frenum pulls. In recent years, a wide variety of surgical procedures have been developed and described in case reports and comparison studies.[14] Some of these surgical techniques are listed in Table 3. In general, these techniques manage mucogingival defects, potentially cover root surfaces, decrease attendant root sensitivity and improve the esthetic results.[14,15]

Dental implants. Not all periodontal therapy involves the treatment of teeth. The replacement of teeth with dental implants and the long-term maintenance of dental implants are also an important part of clinical periodontics today. Many longitudinal studies have clearly demonstrated the predictability of endosseous dental implants in fully and partially

edentulous patients.[16,17] Many implant designs and surfaces have resulted in high success rates (often exceeding 95 percent in good-quality bone).

While most evidence is available for titanium implants, some evidence exists to support the use of hydroxyapatite and titanium plasma-sprayed implant surfaces. There is also evidence to support the use of both two-stage systems, which require a second surgery to expose the implant, and one-stage implant systems.[17-19] Few studies in the literature address specific risk factors. Clinicians should exercise caution when treating patients who smoke and those with untreated periodontal diseases, poor oral hygiene, uncontrolled systemic disease, a history of radiation therapy in the region or active skeletal growth.

Consensus: surgical periodontal therapy. The evidence is clear that surgical pocket therapy results in the reduction of mean presurgical probing depths for periods exceeding 5 years. Evidence also demonstrates that regeneration can be achieved in intrabony defects and mandibular Class II furcations. Many studies have demonstrated dramatic improvements in the ability to cover exposed roots with soft-tissue grafts as well as the predictability of endosseous dental implants in fully and partially edentulous patients.

HOW IS INNOVATION TRANSLATED TO CLINICAL PRACTICE?

Periodontics is a rapidly changing field, with constant innovation improving our ability to diagnose, prevent disease and slow its progression, and regenerate lost periodontium. Innovation may spring from any member of the dental/medical team, and it may influence the type of evidence available to practitioners in judging the value of improvements in periodontal diagnosis and treatment.

The body of evidence clearly demonstrates a clinical benefit for the many surgical and nonsurgical procedures used to treat periodontal diseases today.

Many new surgical techniques, or new uses for existing drugs, are first proposed and used by clinical dentists. Not surprisingly, the earliest descriptions of these methods are often in the form of case reports. These case reports are usually not intended to provide a thorough statistical analysis of efficacy, but they often describe a case with clear benefits. Good results are often revisited in controlled clinical trials. Notably, the degree of benefit derived from the new treatment is often greater in single case reports than in large cohorts of patients entered into a trial. Nonetheless, the body of evidence clearly demonstrates a clinical benefit for the many surgical and nonsurgical procedures used to treat periodontal diseases today.

Another source of innovation are the basic scientists who develop new drugs and devices for the diagnosis and treatment of periodontal diseases. These drugs include both prescription and dentist-delivered drugs, such as chlorhexidine mouthrinse or tetracycline-impregnated fibers, and over-the-counter preparations such as toothpastes and mouthrinses. Each new drug must pass strict guidelines in accordance with the U.S. Food and Drug Administration. In general, two well-controlled clinical trials are needed to be reviewed by the FDA. Therefore, evidence for new drug therapy is based on a high proportion of double-blind, randomized, placebo-controlled clinical trials.

The evidence-based approach offers a bridge from science to clinical practice. The clinician must integrate the evidence with patient preferences, scientific knowledge, clinical judgment and personal experience. The evidence-based approach empowers the clinician by facilitating informed decision-making based on fact, not opinion. Most important, it allows us to care for our patients.

CONCLUSION

The evidence presented at the 1996 World Workshop in Periodontics demonstrated the efficacy of many diagnostic and treatment modalities. However, innovation does not stop with the world workshop. Our profession is constantly striving to improve patient care, through the use of creative but sound scientific principles. Ultimately, we all benefit. ■

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mittee, including Drs. Michael G. Newman, chair; Leonard S. Tibbetts, vice chair; Donald F. Adams; Jack G. Caton; Sebastian G. Ciancio; Robert T. Ferris; Robert J. Genco; Jan Lindhe; James T. Mellonig; Ronald Nevins; S. Timothy Rose; Mariano Sanz; and Robert Schoor.

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