INSTITUTE FOR
Oral Health

Best Practices & Metrics in Oral Health Care

Innovative Solutions for Measuring Quality

WHITEPAPER

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Table of Contents

Introduction

"In terms of measuring quality—by adopting best practices and providing the kinds of resources that help clinicians do their best work, you're going to have better overall care and better overall patient health."

–Dr. David Gesko

The Institute for Oral Health (IOH) brings together experts who have a distinct emphasis or passion in certain arenas of dentistry, who are advancing the profession with innovative programs and research. IOH then shares that information with a larger audience of relevant stakeholders to help affect real changes in everyday dental practice, dental care policy, access, and coverage.

Each year IOH focuses on the new theme of growing concern in oral health care, and throughout 2009 they are spotlighting the issue of "**Defining Quality in Oral Health Care**." Measuring quality within dentistry has long been a challenge. Everyone has their own definitions of quality, which makes it difficult to have a consistent measurement across the overall patient population. It is imperative for the dental profession to change that. As an example, increasingly, payers such as Delta Dental are being challenged by employers to define a greater value proposition for their premiums— i.e., beyond dental services, are they getting healthier employees who become more productive? As Dr. Ron Inge, Executive Director of the Institute for Oral Health and Vice President and Dental Director of Washington Dental Service notes, "*The question has gone far beyond fillings and crowns to, 'Are we impacting their overall health and making them healthier and better employees?' Without metrics, we have no answer to that*."

This IOH focus group, the second in a series on "Defining Quality in Oral Health Care", was an important step forward to learn about and promote valuable work that is being done to measure and improve quality in dental care. Hosted at the Sanctuary Resort at Camelback Mountain in Phoenix, AZ on March 19-20, 2009, the panel discussion was led by Dr. Ron Inge, and featured six nationally recognized experts who discussed key issues and progressive strategies for measuring and improving quality, including:

- Advancing evidence-based care through electronic records – Electronic systems yield many benefits, from guiding clinicians on procedures and interventions to systematizing coding protocols and integration with medical data for a more comprehensive view of patient health and risk factors. Additionally, the systems enable providers to mine data for evidence-based reporting to identify areas for improvement in care delivery, resource management, and clinical competencies.

- Mentoring and developing people – A key part of quality relies on the depth and breadth of experience of the people in a practice, so it is worthwhile area of investment. Mentoring and peer review partnerships for newly practicing clinicians are proving effective in promoting cohesion and consistency across an organization. Furthermore, providing resources for ongoing privileging and credentialing to develop dentists helps to strengthen a practice and improve the quality of care.

- Developing monitors for evidenced-based prevention – The VA's Oral Health Quality Group has been successful in advancing preventative care protocols for veterans through development of monitors on fluoride use and other oral health issues, as well as a systematic review of clinical trials for establishing evidence-based care guidelines.

- Improving quality through accreditation – By aligning with the Accreditation Association for Ambulatory Health Care (AAAHC) standards, practices can elevate the efficiency and effectiveness of providers and the quality of care. The system focuses on accreditation through peer review activities such as auditing and credentialing; process review activities such as clinical protocols and outcomes; and risk management such as patient satisfaction and processes for handling adverse events. Furthermore, what organizations learn through the accreditation process provides a valuable platform of best practices that can be shared across the dental profession.

In follow-up to this year's focus groups on "Defining Quality", the Institute for Oral Health is providing whitepapers and promoting relevant news and research through their website, blog, quarterly newsletters, and participation at health conferences around the nation. Culminating this year's theme is the 4th annual **IOH National Conference to be held October 15 & 16, 2009** in **San Jose, California** at the Hotel Valencia Santana Row. Information and online registration is available at: WWW.IOHWA.ORG.

About the Institute for Oral Health

The Institute for Oral Health is dedicated to improving oral health in America by bridging the gap between research and everyday dental practice. Serving as a central resource for education and collaboration, IOH brings together nationally recognized experts to focus on important themes of concern in oral health care today, and works to promote innovation and adoption of progressive treatment guidelines, dental plans, and delivery methods.

Panel Presentations

Craig Amundson, DDS
CEO and Former Dental Director of HealthPartners, Inc.

David Gesko, DDS
Dental Director and Senior Vice President of HealthPartners, Inc.

Best Practices & Metrics in Oral Health

Joining this Institute for Oral Health focus group were two leaders from HealthPartners, Inc., a large organization that includes HealthPartners Dental Group, with 17 offices in the Minnesota Twin-Cities area, and the HealthPartners PPO network supported by 1,900 dentists around the state. After 28 years as Dental Director for HealthPartners, Dr. Craig Amundson returned to general dentistry, and continues to collaborate on HealthPartners' programs dedicated to public policy, disease management and systemization of care. He was joined by his colleague, Dr. David Gesko, who spent 20 years in dentistry with Kaiser Permanente before joining HealthPartners as Dental Director in 2008. Together, they shared valuable insights on the progressive programs that HealthPartners has put in place for measuring and improving quality in dental care.

Opening the discussion, Dr. Gesko emphasized that quality and cost go hand-in-hand because people care about what they are spending on their health care and how much value they get for their money. When people ask, "Why should I join your practice?" dentists need a compelling answer – and having metrics for quality is an effective way to address that.

As a foundation, Dr. Gesko detailed the HealthPartners Dental Group "practice principles" and the related solutions they have implemented, which include:

- Delivery of care based on evidence-based care guidelines
- Focus on disease management, risk assessment & risk reduction
- Preservation of hard and soft tissue
- Integration of a medical model into dental care
- Maintaining & improving overall cost-of-care

Delivery of Care Based on Evidence-Based Care Guidelines

HealthPartners Dental Group (HPDG) has developed a number of clinical guidelines that are available on the National Guideline Clearinghouse website (www.guideline.gov) including those for caries, periodontal risk assessment, and oral cancer. Additionally, the Institute for Clinical Systems Improvement "champions the cause of health care quality" by developing care guidelines and publishing them on their website (www.icsi.org). Providers can take a vital step forward in improving quality by using and holding themselves accountable for these types of care guidelines.

Focus on Disease Management, Risk Assessment & Risk Reduction

To help reduce risk of disease while increasing patient health and satisfaction, HealthPartners Dental Group (HPDG) has implemented solutions that enable them to track valuable data while improving care delivery, including:

- Electronic Dental Records – All participating dentists leverage the benefits of an electronic dental records system that not only tracks data on patients but helps to guide care delivery protocols. For example, when inputting risk assessment data (for caries, periodontal disease, or oral cancer), the tool can prompt clinicians to do certain procedures by providing recommended interventions and related research. As technology advances, these electronic systems are expected to become more sophisticated to include logic and intelligence that can suggest potential risks based on criteria entered about a patient.

  For providers, the real value in adopting these technologies is what the systems can report about the quality of care and outcomes —a valuable measurement for providers, payers and patients. For instance, by tracking the number of risk assessments and interventions performed for moderate and high risk patients, dental professionals can get a picture of how much impact they are having on improving patient health.

  "The ability to mine this data and take advantage of it is a great selling point for electronic records. For example, we've done enough research on our risk assessment process to know that it's a valid predictor of future use of resources."

  –Dr. Craig Amundson

- Patient-Friendly Personal Care Report – As an additional risk reduction strategy, in mid 2008 HPDG introduced the "Personal Care Report", a chart given to patients —written in patient-friendly language— that highlights their levels of risk for caries, periodontal disease, and oral cancer, and provides recommendations on how they can reduce their risk. As HPDG also measures patient satisfaction, this report, which has proved to be extremely popular with patients, supports a positive perception of quality, reinforcing the patient's sense that their dentist is offering them helpful advice on what they can do to improve their oral health.

  To help promote a consistent level of quality across their network providers, HPDG tracks how many of these patient reports are printed vs. exams performed in order to measure a given clinic's performance on whether or not they are using the report.

- Measurement of Patient Perception of Quality – In 2008, HPDG surveyed patients on a variety of factors to determine how they perceive quality in their dental care. A sampling of criteria includes whether they feel they got enough time with the dentist; how well their condition was explained and how they should handle symptoms; if they got a chance to ask questions; and so on. The survey also looked at the patient's perception of how well their risk levels were explained to them, and whether or not the clinic provided information that enabled them to make good decisions about their oral health care. Here, the new Personal Care Report proved a great success, supporting a rise in patient satisfaction in this area from 73% to 85%.

- Mapping Findings to Diagnostic Codes & Treatment Plans – In their electronic dental records system, HPDG clinicians can enter patient findings, which then auto-populates the record with diagnostic codes, allowing them to track and measure cause and effect across the patient population. Additionally, as the tool prompts providers to enter the amount of time spent on procedures, the organization can measure this data, compare it with data on quality outcomes for those procedures, and establish guidelines for appropriate amounts of time for those procedures.

Preservation of Hard and Soft Tissue

To help patients understand caries and make better decisions about their oral health care, clinicians at HealthPartners Dental Group have found it helpful to educate patients on the typical "life cycle" of a decaying molar. The electronic dental records system includes codes and fees for treatment at various stages in the cycle of decay, which enables providers to explain the cost and impact of their condition over time, and promote early treatment as a cost-effective strategy. In this way, providers are moving away from the "drill, fill, and bill" mentality and adopting a more prevention-oriented paradigm.

Integration of a Medical Model into Dental Care

An important part of improving quality in oral health care is to better integrate dentistry with medical care. At HPDG, the electronic dental records system provides direct access to their website of medical information and resources designed to help dental providers improve the care of patients with chronic conditions such as diabetes or heart disease, and learn how they can "manage the medical condition dentally." These medical resources are particularly important to ensure safer dental treatment for patients on medications, helping to avoid adverse events.

> *"In terms of measuring quality-- by adopting best practices and providing the kinds of resources that help clinicians do their best work, you're going to have better overall care and better overall patient health."*
>
> *–Dr. David Gesko*

Many of the HealthPartners Dental Group clinics are set up as joint medical and dental offices, where there is coordination of care between physicians and dentists. In this collaborative practice, physicians can help identify high-risk patients and refer them for dental treatment early on. This early detection is particularly vital with children –in fact, the group has a pediatrician who is teaching work teams how to work together to provide the most effective and proactive dental and medical care for kids.

This proactive and collaborative approach is key to improving quality in oral health care because it contributes more directly to the overall health and well-being of the patient. Quite often, dental providers see patients only after symptoms and disease have emerged, i.e., when patients are already at moderate to high risk. By integrating with medical care, dentists may have the opportunity to support patients at a much earlier, low-risk stage, and design risk factor modification into their treatment plans.

> *"It's important for dentistry to integrate with the health care system because it uses the same risk analysis and interventions for a number of chronic diseases. In dentistry we usually don't have the resources to invest in that, so we need to leverage the knowledge of physicians"*
>
> *–Dr. Craig Amundson*

Furthermore, dentists and physicians use a similar model for determining risk levels and related interventions at various stages; they are simply doing it for a different set of diseases –but for a patient, it is all happening in one body and should be addressed in a cohesive, integrated way.

Maintenance & Improvement of Overall Cost-of-Care

Focusing on the aforementioned best practices, HealthPartners Dental Group is striving to make quality dental care more cost-effective for patients, providers, and purchasers. For example, when approaching employers about dental coverage, a strong selling point is that HPDG offers a "minimally invasive, prevention-oriented" system, at a considerable savings over the HealthPartners PPO network. From a plan and patient liability perspective, HPDG can save an organization up to 29.2% while delivering quality care that helps promote healthier outcomes for the long term.

John Snyder, DMD
Dental Director and CEO, Permanente Dental Associates

Defining Quality in Oral Healthcare: The "Big Q"

At Permanente Dental Associates (PDA), a for-profit professional corporation that supports the only dental program within Kaiser Permanente, Dr. John Snyder leads a large dental group with 16 offices in and around Portland, Oregon, including six locations on or near Kaiser medical campuses. For this Institute for Oral Health focus group, Dr. Snyder shared the performance management system his team has developed for defining, measuring, and implementing solutions for improving quality of care.

Dr. Snyder began by emphasizing that to define quality, we need to consider a combination of factors, including:

- Patient Preferences & Values – How does the patient perceive the care experience? How do we improve it?
- Clinical & Patient Circumstances – How are we managing quality across the many unique variables? How is quality impacted?
- Experience and Judgment – Are we recruiting, retaining, and fairly compensating the best and brightest talent?
- Scientific Evidence – Are we using and adhering to evidence-based guidelines? Are we monitoring quality and implementing solutions to improve it?

> *"In the marketplace, quality is assumed. But in reality, adherence to the principles of evidenced-based dentistry, clinician judgment, and patient perception are huge factors in how we need to define quality of care."*
> *–Dr. John Snyder*

Creating a Performance Management System for Defining Quality

Guiding the Process with a Management System Map

"How do you know if you are providing quality care?" To get an accurate picture and create a structure for the measurement process, Dr. Snyder and his team developed a Management System Map, which included a number of important elements to guide the process, including:

- Foundations & Key Goals – Set the trajectory for quality by identifying core Mission and Values of the group, and defining the Key Goals they need to achieve in order to fulfill their Mission. PDA's key goals are to be the model of evidence-based care; to be the practice of choice for patients and providers; to be a recognized leader in dentistry; and to have financial strength.
- Core Process Measures – These measure the fundamental processes that are done routinely in the practice of dentistry that influence quality, such as how well they are doing in terms of managing the care experience; advancing the standard of care; staffing and developing dentists; utilizing specialty services; and compensating the dentists.
- Outcome Measures – The overall performance metrics that measure how well they are achieving the Key Goals that influence quality such as accessibility of care for new members and existing patients; patient satisfaction and likelihood of recommending the practice to family and friends, and long-term retention of dentists in the group.

Measuring Performance with a Scorecard

Next, the PDA team developed a Performance Measures Scorecard for tracking quality across a number of fundamental business processes. For each process, they defined specific measures that seemed the strongest indicators for levels of quality. For example, in measuring how well they were "managing the care experience", they asked patients to rate their dentists' "concern for comfort" and their own likelihood of recommending the dentists. The scorecard enabled PDA to effectively measure performance across their organization including target vs. actual ratings, status, and trends.

Improving Quality through People – Recruiting & Retaining the Best Talent

One of the "strategic pillars" in improving quality is a focus on the people in the dental practice. In addition to looking at clinical performance, it is important to measure how well the organization is doing at managing human resources –i.e., recruitment and retention. Are you attracting the best and the brightest? And are you providing a compelling reason for people to stay with the practice? Your ultimate quality goal should be for patients to have long-term relationships with their personal dentist.

- Measuring quality in recruitment – PDA evaluated the recruiting process from various angles, such as their ability to attract talent (applicants per open position) and the quality of their compensation system (how many top candidates accepted offers).
- Measuring quality in retention – They measured retention to determine how long dentists were staying with PDA; and how many opted to become associates and shareholders in the group (indicating long-term commitment).
- Measuring continuity of care – They looked at continuity from a patient perspective, measuring how often a patient's personal dentist conducted their recall exams and emergency care.

Investing in the Beginning: Mentoring New Associates

When including people in the equation of quality, it is critical that an organization invest in those people by providing appropriate mentoring and guidance to promote cohesion and consistency across the organization. For instance, PDA makes a commitment to mentor new associates to emphasize elements such as the organization's evidence-based philosophy of care; the focus on prevention rather simply treating the consequences of disease; and consistent use of risk assessment tools.

In PDA, new Associates benefit from a six month mentoring program. Associate dentists (1-3 years in their clinical practice) are paired with peers, forming an informal review committee to help guide and improve their performance. Additionally, the Board of Directors makes an effort to remain highly visible, "rounding" on new Associates the first 30 and 90 days of their tenure with PDA to ensure they understand that they are valued and have the support to provide the highest quality of care.

Developing Dentists with Ongoing Privileging and Credentialing

As an additional measure to invest in developing their dentists, PDA provides privileging and credentialing process. Dentists must go though a process to demonstrate they have the training and capabilities to perform a procedure on a consistent basis. For example, PDA recently completed a 12-month cycle of Continuing Education on restoring implants. After fulfilling the first component of continuing education and hands-on training, the dentists

must then demonstrate proficiencies (e.g., restore several implants) which are reviewed by a senior dentist. They then receive a credential that qualifies them to perform that procedure on a regular basis.

Practicing at the Leading Edge of Knowledge

Another important factor in strengthening their workforce is PDA's commitment to shortening the gap between research and clinical application. In 2008, 57% of their dentists participated in the Dental Practice Based Research Network to share the latest knowledge and best practices

Improving the Quality of Service

Measuring and Improving Access to Care

For many patients, a "driving factor" in their perception of quality is the ability to easily access care when they need it. During 2008, PDA measured the organization's effectiveness in accessibility, looking at timeframes for access by new patients and those returning for routine care. They determined that new patients have been seen within about 3 weeks and routine care patients within 3-4 weeks. In an effort to improve the timeliness of access, they now publish a weekly scorecard for all 16 PDA offices and each office can then individually take steps such as adding resources if necessary.

Additionally, PDA measured access for specialty care such as pediatrics, periodontics, endodontics, and oral surgery. They now use these measurements to determine how to best allocate resources in order to meet their target quality benchmarks.

Measuring Patient Perceptions

As the true measure of quality is how the patient feels about the care they receive, PDA measured patient satisfaction and perceptions across a number of factors, including:

- Satisfaction with overall quality of service (a composite measure of about 35 questions, ratings for which were rolled into the "overall" result)
- Likelihood of recommending their dentist
- Referral of new members into the dental program
- Perception of their dentist's "concern for comfort" (required a satisfaction rating of "Very Good" to be considered high enough quality for patients to recommend the dentist)
- Time spent by dentist (required a satisfaction rating of "Very Good" to be considered high enough quality)
- Explanation of treatment options (required a satisfaction rating of "Very Good" to be considered high enough quality)

Monitoring Quality in Everyday Practice

Yet another aspect of defining and improving quality is to perform quality assurance to monitor how well the organization and individuals are performing in achieving key goals. For example, PDA aspires to be the model of evidence-based care; to integrate effectively with medical care; and to be uncompromising in our pursuit of quality. It is important to evaluate the extent to which the dentists in the group are actually practicing in ways that satisfy those goals.

Measuring Fundamental Processes

As a quality assurance audit, PDA measurements include:

- Preventative care – As PDA's vision is to be the model of evidence-based care, it was important for them to evaluate the extent to which they are actually practicing it. For example, they looked at the rate of individualized care for high risk patients and whether those patients received appropriate preventive services by every dentist.
- Radiographic quality – They audited this element, knowing that care will be impacted if films are not diagnostic.
- Peer Review Process – PDA recognized that "transparency and trust" were key to strengthening their focus on quality, so they looked at how well peers were sharing information through "self reporting" undesirable outcomes to take advantage of lessons learned.
- "Never Events" – They measured the occurrence of events that compromised patient care and safety including the most severe "Level 1 never events" such as extraction of the wrong tooth or post-operative need for hospitalization; less severe "Level 2" events such as those resulting in more complex treatment that may have been avoided; and least severe "Level 3" events such as irregularities in chart documentation. Through this monitoring and then conducting root cause analysis, PDA was able to determine a noticeable improvement in quality, with a distinct decline in "never events" since 2007, and none at all for nearly four months as of January 2009.

Integrating Dental & Medical Care

Another important quality measure was to assess how well the individual practices are taking advantage of integration with medical. For example, they looked at the rate of tobacco cessation attempts, which include providing patients a referral to health education services in the medical program. Additionally, they evaluated other avenues where they are integrating medical care into their dental practice, including placing medical alerts in the dental records of patient exposed to bisphosphonates, "pre-hypertension" referrals for patients with elevated blood pressure and referring adolescents who require immunizations.

> *"It's important to ask ourselves: If we believe that the smile really is connected to the body, and we can't have overall health without oral health, what are we doing about that in our dental practice?"*
>
> *–Dr. John Snyder*

Improving Quality from a Financial Perspective

From a patient perspective, affordability is a strong influence on their perception of quality. In an effort to make their program more affordable, PDA developed measures for identifying areas where resources were being wasted. In particular, they tracked patient DNA (did not attend) rates; unfilled appointments; and staff absenteeism. With the findings, they were able to determine how to reallocate resources across various offices to increase productivity and cost-effectiveness.

In a further effort to improve affordability, PDA measured access to specialty care within the practice and costs associated with specialists care referred outside the practice. In the 4th quarter of 2008, they noted marked improvements in cost reductions, boosted by their efforts to better distribute specialists across their 16 offices.

Improving Quality through Innovative Plan Design

A further key element in improving quality is to develop innovative plans that best meet patient needs. Toward that end, PDA has PDA has supported the development of plans such as PreventaMax, in which preventative services are not charged against an annual maximum; plans that promote evidence-based dentistry wherein sealants and remineralization treatments are 100% covered and only the first surface is counted toward the annual maximum (all other surfaces are at zero cost to the patient); and plans for implant coverage that allow flexibility to create more cost-effective solutions for the patient

An Overall Strategy for Improving Quality

As Dr. Snyder summarized, quality crosses over all aspects of the care continuum including the people involved; effectiveness of service; quality assurance efforts; and the financial drivers that impact affordability.. Improving quality requires a well-organized system for accurately monitoring and managing performance to ensure the organization is investing resources in the right ways and achieving outcomes that match their mission and values. Also vital to improving quality is to establish a practice culture built on “transparency” where openness fosters the growth of individual clinicians and improves everyday operational effectiveness. And lastly, with effective insurance plan designs, an organization can improve quality by making dental care more affordable and accessible to a greater number of people.

Timothy Ward, MA, DDS
Assistant Under Secretary for Health for Dentistry, Dept of Veterans Affairs, Washington DC

Judith Jones, DDS, MPH, DScD
Professor and Chair, Department of General Dentistry, Boston University School of Dental Medicine; Associate Professor of Health Services in the School of Public Health

Improving Quality in Oral Health for Veterans

For this focus group, Dr. Tim Ward discussed the research and programs that have been developed by the VA Office of Dentistry in their efforts to move toward an evidence-based orientation. He was joined by Dr. Judith Jones, who leads the VA Oral Health Quality Group, which defines measures for monitoring quality, conducts evidential reviews, and publishes guidelines to help drive improvements in clinical treatment.

Advancing Health Services Research in the OOD

The Office of Dentistry (OOD) focuses on developing national policy for VA dental care, new program development, and overseeing how care is being delivered. Their strongest emphasis is on patient care, serving 380,000 veterans across 207 dental clinics in 2008. When Dr. Ward joined the OOD four years ago, VA dental services were struggling. Over a ten year period, the budget for dental care had been cut from 1.1% to .89% of the total budget for medical services, a seemingly small percentage but one that represented a large amount of money,. Given their finite budget and limitations on the scope of care they can provide (based on eligibility), Dr. Ward believed the best solution was to advance their research efforts to focus on outcomes and appropriateness of care. The resulting evidence-based clinical guidelines could inform the OOD on how to better allocate resources and would support clinicians in making more appropriate and cost-effective treatment decisions.

Expediting Progress with an Integrated Approach

The Office of Dentistry now has three national programs whose shared mission is to improve oral health for veterans. The committees include:

- VA Dental Practice-Based Research Network(PBRN) – The first federal dental Practice Based Research Network (PBRN), this group of VA dentists are affiliated to perform research and share expertise in a real-world clinical practice. Their goal is to examine clinical questions of particular relevance to veteran oral health and provide data to the VA Quality Group to assist them in examining outcomes of care and developing clinical guidelines; and to share findings with the VA OOD Education Group so they can develop training and resources for the VA Dental Team.

- VA OOD Education Group – This program translates evidence-based research into accessible formats for efficient implementation into clinical practice. Their resources include a website of educational materials and frequent webinars that offer cost-effective ADA CERP accredited Continuing Education. The committee's new quarterly webinars for dental service chiefs focus on management issues. Their popular monthly webinars for the VA Dental Team attracts over 500 VA clinicians each month for topics such as use of fluorides in high risk patients; treating dental patients with post-traumatic stress disorder; the dentist's role in treating sleep apnea; and the diagnosis and treatment of occlusal wear.

- VA OOD Oral Health Quality Group – This committee develops quality monitors, study outcomes, and publishes clinical guidelines and Information Papers in an effort to shape clinical behavior in the field to ensure appropriateness and proper scope of care. The group's efforts are discussed in greater detail in the following section.

These three committees have been closely integrated to encourage collaboration and efficient knowledge transfer. As an example, the PBRN is examining outcomes of endodontic care, the results of which will be handed off to the Quality Group for development of guidelines for care. Similarly, when the Quality Group developed measures for monitoring fluoride treatments, the Education committee in turn created a clinical webinar on best practices for fluoride care.

VA Oral Health Quality Group

To illustrate the importance of the VA Oral Health Quality Group, directed by Dr. Judith Jones of Boston University, Dr. Ward emphasized that, until three years ago, dentistry in the VA was not on the Veteran Health Administration's radar because there were no oral health performance-based measures to be used as a yardstick. Thus, dentistry remained a low priority in the budget. In the 1990's, VA healthcare was transformed by the introduction of electronic medical records and measureable evidence based outcomes of care. As these changes revolutionized health care in the VA, it was crucial for the Office of Dentistry to catch up and get noticed.

In an effort to "promote clinical practice based on the best evidence available," the VA Oral Health Quality Group has drawn upon the valuable work of other VA groups around the country. Located at one of VA's thirteen Health Services Research Centers of Excellence in Bedford, Massachusetts, the Quality Group is also strengthened by a close collaboration with dental quality experts at Boston University. The backbone for much of the quality work performed by this group is the superb data support by Dr. Terry O'Toole, Director of VA Oral Healthcare Analysis.

Highlights of Oral Health Quality Improvements

In the past three years, the OOD has accomplished a number of valuable improvements including:

- Electronic Waiting List – In 2003, VA implemented the electronic wait list to measure access to medical care, however, dental care was not included in this metric. A paper survey in 2005 suggested 50,000 veterans waiting over 30 days to access dental care. In response to this, in 2006, VA implemented the Electronic Dental Waiting List, and in early 2007 that electronic list was integrated into the official master waiting list, representing a major step forward in gaining recognition for the value of dental care. This change facilitated greater efficiencies in getting veterans into a dentist, and by December 2008, the dental care waiting list was down to less than 1,000 patients.

"We had over 50,000 patients waiting more than 30 days for dental care –and we didn't know it until we conducted a survey and came up with this astounding number.

That data is important. We were given the resources to take care of these people because we were able to demonstrate our constraint."

–Dr. Tim Ward

- Monitors for Evidence-based Care – The VA Oral Health Quality Group has developed evidence-based guidelines for three important clinical processes including fluoride use in high risk patients; comprehensive evaluations every two years; and treatment based on compelling medical need. In particular, this latter monitor has been important for serving the patient population who were eligible for dental care due to a medical condition impacted by poor oral health. The scope of care provided reflects what is necessary to facilitate the needed medical care; this provides a valuable service to help improve overall systemic health in those patients.

- Integration into the 50 "Performance Clinics" – The VA produces a performance report of 50 clinics in the VA hospital that tracks, among other things, the percentage of patients seen within 30 days. It is an "access indicator," and for a long time, dentistry was left out. Dr. Ward notes. "Every time dentistry is treated differently than medicine, we lose. We lose because we're not part of the mainstream. We must be integrated. Our push has been to be involved at every point along the way." A few months ago, one of the 50 clinics was removed from the list, and dentistry was added to the group.

- Dental Performance Scorecard – The Quality Group developed a simple, graphical tool for reporting performance data that dental chiefs and other hospital and regional administrators can use to track progress at their facility. The scorecard charts real-time data on key measures including: percentage of medically compelling patients treated; comprehensive oral evaluation monitor for eligible veterans; number of patients on the electronic waiting list over 30 days; and preventive fluoride use in high caries risk patients. The tool compares the facility's results with national and regional data.

- Frequency Screening Reports – Another innovation was the development of reports that a dental chief can use to track the frequency of various procedures in order to gauge the quality of providers and ensure that appropriate care is performed. Reports include frequency screenings for: exams by site; in-house and fee-basis procedures by patient; procedure-intensive patients by site; procedures prior to and after extraction; provisional crowns by site; and selected procedures by site. These reports are aimed to validate our coding process, and also to help management identify trends in treatment that may indicate a need for provider education or mentoring.

A Closer Look at the VA Oral Health Quality Group

Led by Dr. Judith Jones for the past year, the Quality Group made it their mission to ensure that the VA delivers care that demonstrates accountability to the veterans, Department of Veterans Affairs, and the taxpayers. They focused on quality as a means to achieve the best value by maximizing available resources, rather than what could be delivered for the lowest cost. With that in mind, their objective was to improve patient care in the VA by addressing four issues:

- Lack of quality indicators and monitors
- Need for evidence-based standards for care
- Need to enhance preventive measures
- Disparities in access and scope of care for eligible veterans

What is Excellent Quality?

It is care that is effective, efficient, patient-centered, timely, safe, and equitable. It is care that is appropriate, where the benefits outweigh the risks by a wide margin, and that incorporates the best available evidence.

--Crossing the Quality Chasm
Institute of Medicine, 2001

The VA Quality Group has been building their work on the valuable efforts of two pre-existing field-based committees, which created the first oral health quality monitor now in effect; and were developing evidence-based guidelines on the use of preventive strategies in reducing caries. The Quality Group was charged with expanding on these existing programs, and develop new methods to further the dental care and research agenda in the VA.

Quality Measures Developed

In their first year, the Quality Group and the Data Analytics Group led by Terry O'Toole developed the following:

- Dental Scorecard – Now used quarterly by every VA facility to track results overall.
- Monitor on Comprehensive Oral Exam – Based on veterans eligible for continuing comprehensive dental care, this monitor looked at patients receiving an exam in a specific 3-month period who had also had a comprehensive exam within the previous 24 months. In this way, they could track improvements on a more immediate basis.
- Monitor on Access to Care for Medically Compromised Veterans – The group also produced an information letter that provides guidance to the field on why it is important to provide dental care for these patients as their medical condition could be improved by dental care. "*Before that, there used to be a lot of angst on whether to take care of these patients, and now it's very explicit,*" said Dr. Jones.
- Monitor on Fluoride Use for High Caries Risk Patients – Based on veterans eligible for continuing comprehensive care, high caries risk patients were defined as those who had received two or more restorative procedures within one year. In particular, the monitor tracked high risk patients who received a fluoride intervention (defined as a prescription for fluoride dentifrice or topical or therapeutic application of fluoride varnish or gel) within 12 months prior to their first restoration and within 6 months after their second restoration. With respect to the fluoride interventions, the Quality Group considered the effort "fully successful" if greater than 60% of high risk patients received the fluoride; and "exceptional" if greater than 75% got the treatment.

Accomplishments Toward Caries Prevention

The VA Quality Group developed and published an information letter for the use of fluoride in the at-risk population (Gibson, Jurasic, Wehler, Jones, 2008), which they distributed to the field through the Office of Dentistry.

The group also conducted two webinars for the field: one on caries risk assessment, which explained the fluoride monitor; and the other which discussed the process the Quality Group used for systematic review of literature as an example of evidence-based activity. Additionally, the group is in the process of writing up their findings for a peer-reviewed publication on systematic review of anti-caries agents and their effectiveness in preventing caries in adults. Dr. Jones added that while there have been good publications on the subject in recent years, findings from their review will make an important contribution to the existing literature.

Yet another success was that the Quality Group was granted their request for the VA national formulary to ensure universal availability of 1.1% NaF gel and/or dentifrice and fluoride varnish.

Incorporating Evidence-Based Dentistry into VA Dentistry

In February 2009, two members of the VA Quality Group, Dr. Marianne Jurasic and Dr. Gretchen Gibson, presented a webinar that outlined their process for a systematic review of evidential literature, using their experience with the fluoride review as an example.

Their presentation focused on the following:

- Steps in a Systematic Review – First the group defined factors in the key clinical question, including:
  - Population or patient type (e.g., moderate- high caries risk adults)
  - Intervention or exposure (e.g., professionally or self-applied fluorides)
  - Comparison (e.g., placebo or alternative regimens)
  - Outcome (e.g., decrease or remineralization of carious lesions)
- Selection of Studies – Using a two stage process, they first evaluated titles and abstracts to determine which full text papers should be reviewed; and then evaluated full papers to ascertain which studies were suitable for further review and data abstraction. Additionally, they maintained a log of which studies were excluded and why; and they created an evidence table for tracking study size, subjects, methods, outcomes, and quality score (determined by grading studies using the CONSORT checklist of criteria for proper development and reporting of clinical trials).
- Results – The group retrieved 99 full text (English language) articles to identify RCT/clinical trials; evaluated 53 RCT/clinical trials for inclusion in the final review; included 19 RCT/clinical trials in the final evidence table; and one additional Polish-language study was translated and included.

Other Quality Improvement Activities

In addition to their work on monitors and systematic reviews of evidence, the VA Quality Group has explored a variety of other strategies for improving quality, including:

- Improving diagnostic codes – They investigated ways to improve the accuracy of diagnostic codes, looking at categories of procedures (such as perio, extractions, and restorative), and working with the coding group to develop new items for populating drop-down lists in the Electronic Medical Record. In fact, in a future "patch" of the EMR, these lists will force clinicians to choose the diagnostic code most relevant to the procedure they are doing rather than accepting a default code.
- Surveying self-rating of oral health – Dr. Jones discussed an article describing a national health survey of over 179,000 veterans who were not receiving VA dental care (which had an impressive 63.3% response rate), which indicated that the self-rating of their oral health "lagged behind" the general U.S. population. For instance, only 19% of veterans rated their oral health as excellent/very good, compared with 51% in the general population; whereas 53% of veterans rated it as fair/poor, as opposed to only 13% of the general population who thought their oral health was failing. Additionally, they found variations in self-ratings of oral health based on geographic region, gender, age, and race (e.g., African Americans rated their oral health 29% poorer than white veterans; and Hispanics rated 18% poorer). The study also indicated that the self-ratings for oral health (predominantly fair to poor) are associated with those for general health and functional status, which, Dr. Jones noted, "may have important implications for monitoring the delivery of oral health care in the VA and other systems of care." (Jones et al., 2006; Florida Dental Study, 1998; VA National Health Survey of Veterans, 1999)

Only 8% of veterans receiving medical care are eligible to receive dental care.

This national health study and the monitors developed by the VA Quality Group are strong indicators that "*VA patients clearly need more attention to their oral health.*" Furthermore, Dr. Jones stated that it is critical that the VA and the profession "*determine longitudinally if*

dental care improves self-rated oral health as well as general health and quality of life in our patients." She added that a recent study showed that patients who rate their oral health as fair or poor showed significant improvements after getting dental care, and suggested that self-rating surveys might be a useful tool to incorporate into practices as an indicator of risk (Kim et al., 2009 [IADR Abstract]).

What's Next for Improving VA Oral Health

The VA Office of Dentistry committees are continuing to conduct research and develop measures for monitoring and improving quality in their dental care programs such as:

- Homeless Dental Program – The VA has a new $16.5 million program to provide dental care for the homeless veterans; twenty-five percent of all homeless are veterans. Services are primarily contracted out through community health clinics and on-site fee basis, with patients eligible only if they are in a residential treatment program for at least 60 days. This program, offering a limited scope of care, is designed to improve oral health to help the homeless get employed. So is it working? To measure the effectiveness of the program, the VA Oral Health Quality Group has been studying outcomes. While they have gathered data on patient visits and services rendered, they are also interested in measuring the social impact; for instance, are they making improvements in patient oral health, feelings of self worth, and employment status?
- Long-term Care Oral Hygiene Standards – In 2008, the OOD published a study of VA nursing home patients that showed how providing good oral hygiene on a daily basis reduces the incidence of aspiration pneumonia. The OOD is now collaborating with the Offices of Nursing, and Geriatrics and Extended Care in a pilot project to train nurses as oral health champions in providing oral care to ensure nursing home residents get their teeth brushed every day (Bassim, Gibson, Ward, Paphides & DeNucci J Am Geriatr Soc. 2008 Sep;56(9):1601-7)
- Endodontic Outcomes – The OOD is starting to develop measures to track the longevity of their endodontic treatments to determine their effectiveness compared with implants.
- Cranioplasty Outcomes – In collaboration with the Department of Defense, the OOD is measuring clinical outcomes for severely injured veterans who have had a cranial implant for trauma related injury.

The EMR as a Tool for Improving Quality

In closing, both Dr. Ward and Dr. Jones emphasized the value of the Electronic Medical Record (EMR) in advancing the effectiveness of dental care delivery. At the VA, EMRs have enabled integration of medical and dental data that gives clinicians a more comprehensive view of each patient's health concerns –a vital factor in ensuring that appropriate care is delivered. Additionally, the EMR allows providers to develop templates for entering notes, making patient record-keeping more efficient and systematic.

> *"It's a wonderful system. You have access to the patient's problem list, medications, allergies, and any alerts such as a suicide risk. You also have access to every note, lab and test they've had done –and all that's very important and useful if you're trying to understand who your patient really is."*
>
> *–Dr. Judith Jones*

To date, most commercial Dental EMRs have focused on billing or productivity, but the OOD is working to expand the VA EMR to more easily facilitate research and quality. Similarly, Dr. Ward urged all oral health quality advocates to get involved in the development of Dental EMRs to ensure that what providers really need –such as quality data for tracking performance and outcomes– is built into these systems.

Kenneth Sadler, DDS
President and Administrative Director, Winston Salem Dental Care

Quality Management and Improvement Program

Heading a large multi-specialty dental practice in Winston-Salem, North Carolina, Dr. Kenneth Sadler oversees a staff 150 people, including 22 dentists who serve about 2,000 patients each week. Founded in 1978, the practice has always focused on new ways to define, assure, and improve quality, and in this Institute for Oral Health focus group, he discussed the programs they have developed for quality management, internal audits, and provider privileging and credentialing.

Quality Assurance vs. Quality Improvement

"*When defining quality, it really comes down to how patients feel about how you take care of them*," Dr. Sadler noted, adding that at Winston Salem Dental Care (WSDC) they had learned that patients presume their dentists are clinically competent, so it was necessary to look at quality in new ways beyond traditional quality assurance methods.

In the early days, their quality assurance efforts were focused on auditing their procedures (forms filled out correctly; coded included), processes (appropriate care delivered; no adverse outcomes), and providers (address any recurring problems or need for further education) – all intended to "assure" that everything met certain quality standards. Yet there were no real goals toward innovating improvements.

"Our guiding philosophy is to provide care that is:
- Comprehensive
- High Quality
- Accessible
- Personalized
- Preventively-oriented

If we can deliver on all these principles, we will provide patients with a quality experience."

–Dr. Kenneth Sadler

Quality Management & Improvement Program

To advance their efforts, WSDC developed a progressive Quality Management and Improvement Program (QMI) that would support accreditation. Dr. Sadler noted that while the Accreditation Association for Ambulatory Health Care (AAAHC) (www.aaahc.org) holds organizations to nationally-recognized standards, they are consultative and collaborative, allowing flexibility in how facilities achieve those standards. Their accreditation approach requires data on the following areas: peer review activities, process review activities, and risk management.

Peer Review Activities

In their QMI Program, WSDC includes the following peer review activities:

- Non-Clinical Auditing – Procedural audits; analytical audits; and tracer audits. They also audit their hepatitis immunization program, as their practice includes a nurse who administer immunizations, so they track progress and outcomes.
- Clinical Examination and Case Reviews – Complex case planning and implant/orthognathic surgery reviews, both of which benefit from collaborative support between experts in the practice; and specialty care clinical reviews, which bring in external experts to advise on treatment plans.

- Provider Credentialing and Recredentialing – Peer evaluation; administration oversight and ongoing surveillance; credentialing procedures; and special credentialing areas.
- Provider Privileging – Providers apply for privileges such as general dentistry; general dentistry plus (which includes additional procedures such as implants, IV sedation, moderate sedation, etc).

Process Review Activities

The WSDC Quality Management & Improvement Program also tracks process review activities, including:

- Clinical Protocols – Since opening the practice in 1978, WSDC established protocols for care, and they continue to update them annually.
- Quality Improvement Studies – WSDC collaborated with external experts in an effort to gain outside validation for the quality efforts they were doing internally. They evolved their studies from quality assurance to quality improvements to better support the type of practice they were developing.
- Patient Care Tracking – Looks at appropriateness of care and outcomes.
- Laboratory Quality Control – Tracks accuracy and efficiency of lab protocols and services.

Risk Management

Another important quality management variable required by the AAAHC is risk management, and WSDC has addressed this with following:

- Patient Satisfaction & Patient Advocacy – They partner with the Press-Ganey company (www.pressganey.com) for conducting quarterly satisfaction surveys, and use their own telephone survey. They also provide a staff member to field calls from patients who may have concerns about their health, provider, or coverage.
- Adverse Incident Management – In addition to simply noting adverse events, they developed a system for collecting and reporting on the related data. For accreditation, the AAAHC expects organizations to be able to produce data on adverse incidents, cause analyses, and what is being done when these incidents occur.
- Provider Impairment/ Incapacitation – As an additional risk management measure, it is important to address any issues that preclude providers from delivering quality care, such as an accident in the course of delivering care, or alcohol/drug abuse.

Furthermore, the WSDC QMI program tracks other risk factors including the quality of their facility and environment; how they are handling financial services, external relations, and HIPPA compliance; and how they measure up against their competition.

The Road to Accreditation

Winston Salem Dental Care was first accredited by the American Academy of Dental Group Practice (AADGP) accreditation program in 1983. That organization later became part of the AAAHC around 1992, and WSDC has been accredited by the AAAHC continually ever since. WSDC chose to align with the AAAHC because they use a "*recognized and organized approach to accreditation with clear standards*" detailed in a manual that organizations can use as a guide.

AAAHC Standards for Quality

Dr. Sadler highlighted examples from the AAAHC Self-Assessment standards manual that apply to all types of health organizations such as chapters on Rights of Patients, Governance, Administration, Quality of Care, Quality Management and Improvement, Clinical Records and Health Information, Facilities and Environment, Anesthesia Services, Surgical Services, and Dental Services. The comprehensive manual details numerous letter standards and all the supporting elements that the AAAHC applies when evaluating a practice. (This manual and other handbooks are available for purchase on the AAAHC website: www.aaahc.org)

"We all believe we're doing the right thing by our patients, and the systems and processes we have in place are what need to be there. We think of the world that way –until we have an agency like the AAAHC come in and take a second look. You don't know what you don't know."

–Dr. Kenneth Sadler

In particular, the Governance chapter includes a subchapter on credentialing and privileging. The AAAHC uses a very formalized process for credentialing, supported by committees that continuously update the standards based on changes in the field. Additionally, their education component goes into the field to provide training on an ongoing basis. As an example, Dr. Sadler provided an excerpt on privileging standards:

> *Privileging is a three part process. The objective of privileging is to determine the specific procedures and treatments that a health care professional may perform. An accreditable organization:*
>
> *1) determines the clinical procedures and treatments that are offered to patients.*
>
> *2) determines the qualifications related to training and experience that are required to authorize an applicant to obtain each privilege; and*
>
> *3) establishes a process for evaluating the applicants qualifications using appropriate criteria and approving, modifying or denying any or all of the requested privileges in a non-arbitrary manner.*

Sharing Best Practices Through AAAHC

A particular benefit of being involved in the AAAHC accreditation program is that organizations can share best practices they have identified in the course of the efforts to align with standards. It provides an effective, centralized venue for valuable knowledge transfer, and an opportunity for all of the dental profession to partner on improving quality improvement on a larger scale.

In fact, there are currently 4,155 health care organizations accredited through the AAAHC, and 110 accredited dental practices. There are also 15 oral/maxillofacial practices and 247 practices that support oral and maxillofacial activities –all of which represents a considerable network of providers dedicated to quality improvement in oral health care.

"Many of us face similar issues in dental practice that cause us to search for solutions, so it is important to have more dental organizations involved in the AAAHC."

–Dr. Kenneth Sadler

AAAHC Institute for Quality Improvement

The AAAHC includes a component dedicated to developing clinical performance measurements for quality improvement. Until now, it has focused only on medical care, but the WSDC has been lobbying for them to include dentistry. Currently, the AAAHC Institute's studies are comprised of relatively brief surveys and graphical reports, designed specifically for the ambulatory care environment, and they provide organizations the opportunity to trend their performance over time through repeated examination of a variety of procedures.

Additionally, the Institute has a Performance Measurement Initiative (PMI) involved in benchmarking to provide organizations information on how their performance compares with their peers. Currently, this effort is focused only on medical care; however some of the studies may still be helpful to dental practices as they offer best practices on themes such as patient satisfaction and retention; marketing and gaining competitive edge; building teamwork and improving communication; using lessons learned; and creating a "quality culture" in an organization. Studies are available on the AAAHC website, and organizations can register to participate in upcoming studies (www.aaahciqi.org).

Panel Discussion Highlights

In this Institute for Oral Health focus group on their 2009 theme "**Defining Quality in Oral Health Care**", the panel of experts shared open forum discussion on some of the presentation topics, including…

Making the Investment in Quality

Dr. Kenneth Sadler of Winston Salem Dental Care (WSDC) noted that while most all providers are trying to do the right thing, it is likely they can improve on what they are doing. Yet to effectively identify necessary changes costs money, and that may be a point of resistance for many practices. For WSDC, a two-day survey costs about $12K, which includes two external experts conducting on-site evaluations. He believes it is a worthwhile expense when there is an opportunity to gain something valuable in return.

> *"If we prevent even one patient from being harmed as a result of someone observing something that might be done better, then it is worth it."*
>
> *–Dr. Kenneth Sadler*

Dr. Jess Ruff of American Dental Partners (ADP) stated that in his organization, which includes practices across 18 states, all affiliated practices are required to go through an accreditation program every three years. "*It's a quality improvement project in itself because every time the providers go through it, they have to get better.*"

Sharing Best Practices through Accreditation

All of the focus group participants agreed that the accreditation process provides an excellent forum through which to learn best practices, as it provides exposure to a wide range of experiences on what other people are doing. As Dr. Tim Ward of the VA Office of Dentistry noted, "*If we had to define all this on our own, it would take forever; maybe we'd never get there.*"

Dr. Ruff mentioned that tools such as the **Performance Scorecard** (detailed in the presentation on VA Oral Health Quality by Dr. Ward and Dr. Jones) have been effective in getting the doctors, staff, and administrators across his organization to start talking about quality issues. Their collaborative discussions have helped to inform all the practices about directions they need to go.

Going forward, Dr. Ruff added, as practices affiliated with ADP go through the accreditation program, ADP may take a deeper look into the processes that are being used. Using the AAACH standards as a model, an organization can employ a number of interventions at the structural level to ensure that they are doing the necessary procedures, making the best use of resources, and verifying the competency of individuals in the practice.

Referring to the AAAHC risk management standards for handling provider impairment mentioned in Dr. Sadler's presentation, Dr. Ward recounted an experience in which he had to confront a colleague with a significant drug abuse problem who admitted he had been using for some time and often could not remember patients he treated only a week earlier. Dr. Ward added, "*If we had had some sort of process as to what to do with that man, it sure would have helped.*"

When considering the common lessons learned through surveys and the accreditation process, Institute for Oral Health Advisor Dr. Martha Somerman offered her insights as an educator, stating that it would be extremely helpful to channel these insights back to the dental schools so that they can use the information to improve curriculum and clinical training.

Dr. Ron Inge, Executive Director of IOH and Vice President and Dental Director of Washington Dental Service (WDS), added that a few years ago, the California Association of Dental Plans and the National Association of Dental Plans attempted to start developing an accreditation process, but it was soon perceived as "onerous and costly," so it was abandoned. Yet the AAAHC standards handbook includes many things that WDS includes in the quality improvement program in their plan.

"At Washington Dental Service, our plan tends to be more forward thinking. We are willing to invest in our credentialing process because we see the value in it."

–Dr. Ron Inge

He added that concern over quality is a common challenge. When they direct someone to a doctor in the network, what do they know about that doctor's abilities? What do they know about that facility and its ability to provide care? With managed care environments, they go out and check on them. "*Yet with commercial practices*," Dr. Inge noted, "*it's freedom of choice, therefore 'buyer beware.' I don't feel comfortable with that, so I'm looking for ways that we can reach out to those providers, increase communication and oversight, and gain better peace of mind that when we send patients to those doctors, they will receive at standard of care that's acceptable*."

Additional Participants

Ron Inge, DDS

Executive Director, Institute of Oral Health; Vice President and Dental Director, Washington Dental Service

Mary Ellen Young, RDH, MPH

Assistant Executive Director, Institute of Oral Health

Darlene O'Neill

Business Manager, Institute of Oral Health

Lt. Commander Jeff Chaffin, DDS

General Dentist, U.S. Army

Dr. Chaffin is an active duty Army dentist working for Public Health, which provides no-cost insurance programs. Dr. Chaffin participated in the focus group to explore ways to integrate quality measures into their dental contracts.

Jess Ruff, DDS

Senior Vice President and Chief Professional Officer, American Dental Partners, Inc.

American Dental Partners is a leading business partner helping to bring value to dental group practices through effective strategies that improve the quality of care and efficiency of management, with the goal to build organizations that endure and excel.

Martha Somerman, DMD, PhD

Dean, University of Washington School of Dentistry; Professor, Departments of Periodontics and Oral Biology; Institute for Oral Health Advisory Committee

Dr. Somerman is dedicated to innovating dental education curriculum and access to health care. Her NIDCR/NIH funded research group focuses on understanding mechanisms controlling the development and regeneration of the dento-alveolar complex with the long term goal of devising predictable therapies to regenerate oral craniofacial tissue. Dr. Somerman is a fellow of the American Association for the Advancement of Science.