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**THE IMPLICATIONS OF PROTOCOL-BASED CARE
ON DENTAL SERVICES IN THE MILITARY**

BY

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USAWC SENIOR SERVICE COLLEGE FELLOW RESEARCH PROJECT

**The Implications of Protocol-based Care on Dental
Services in the Military**

by

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ABSTRACT

AUTHOR: Colonel Lawrence J. Cook

TITLE: The Implications of Protocol-based Care on Dental Services in the Military

FORMAT: Senior Service College Fellow Research Project

DATE: 1 May 1998 PAGES: 35 CLASSIFICATION: Unclassified

Downsizing, limited resources and rising costs are challenges to the military health system. Variations in diagnosis and treatment of dental disease add to the demands on the delivery system to provide access and ensure quality for uniformed personnel. Evidence-based dentistry is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. An evidence-based practice combines the individual clinical expertise with the best external evidence available from systematic review of research findings. It provides a scientific basis for patient care, planning and implementation of health services, and development of health policy. Practice guidelines formulated on scientific evidence reduce variations in diagnosis and treatment for various dental conditions. A risk assessment protocol for treating dental caries can decrease operative dental treatment recommended at the initial examination and reduce the need for restorative care over a military career.

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ACKNOWLEDGEMENTS

The author acknowledges the support provided by the Center for Practice and Technology Assessment, Agency for Health Care Policy and Research and the Department of Health and Human Services during his fellowship.

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Downsizing, limited resources and rising costs continue to require the health care system to seek improved efficiencies in providing care to patients. Patients expect value, quality, improved outcomes and ready access to the care they need. Providers want to deliver quality care efficiently. Payers and health plans desire treatment that results in cost-effective, measurable and improved outcomes. An Institute of Medicine report defines quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."¹ Implementing a protocol-based approach in the Army Dental Care System can assist in dealing with limited resources and achieve the goals of readiness, access, and quality care. Protocols developed from scientific evidence can reduce inappropriate variation in treatment, improve access to services and assist providers in delivering effective quality care that ensures soldier readiness.

EVIDENCE-BASED PRACTICE

An evidence-based practice provides a scientific basis for patient care, the planning and implementation of health services, and the development of health policy. An evidence-based practice requires relevant, high quality and well-designed research studies that yield valid results for providers to implement in their clinical practice.² In recent years, evidence-based practice has become widely recognized as presenting the health care professions a scientific basis for the delivery of health care.³ An evidence-based practice provides the framework for the integration of good science with clinical judgment to ensure that clinical practice leads to improved outcomes.

Evidence-based dentistry is the conscientious, explicit and judicious use of the best evidence in making decisions about the care of individual patients.⁴ It is the practice of dentistry that combines individual expertise with the best available external evidence gained from systematic research.

Relevant research studies are essential for evidence reports and technology assessments. Professional organizations, government agencies and others with an interest in policy and practice can use evidence reports as a basis for development of

clinical guidelines, performance measures, and other quality improvement tools.

The Agency for Health Care Policy and Research

In November 1989 Congress amended the Public Health Service Act to create the Agency for Health Care Policy and Research (AHCPR). The agency has broad responsibilities under Public Law 101-239 to support research and other activities that will "enhance the quality, appropriateness, and effectiveness of health care services."⁵ Among its early responsibilities, AHCPR facilitated private sector development of clinical practice guidelines and undertook intramural assessment of health care technologies as requested by Federal health programs. Beginning in 1997, the Agency moved from facilitation of guideline development and solely intramural technology assessment to support of evidence-based practice centers. Twelve AHCPR Evidence-based Practice Centers (EPCs) assess the scientific evidence in the literature and produce evidence reports and technology assessments.⁶ The EPCs address topics within broad areas that are nominated by organizations, government agencies, purchasers of care, health plans and others with an interest in the topic. The topics may include prevention, diagnosis and treatment of diseases or health conditions; or the use of alternative or complementary treatments. At least six of the EPCs include expertise to conduct relevant systematic literature

reviews in the area of dental health and produce evidence reports or technology assessments. AHCPR widely disseminates the EPC reports and assessments in print and electronically. Professional organizations may use the information to develop and disseminate practice guidelines for providers. A government agency may use the information to develop programs and policy, while payers may use the information to develop coverage policies. Researchers may use the reports in designing future studies.

Systematic reviews

Technology facilitates access to research findings, but analyzing studies and comparing them with previous or similar information is extremely time-consuming. Even the provider with the best of intentions to stay current with the literature finds it difficult to keep abreast of the latest published evidence. Systematic review is a scientific technique that summarizes the best available evidence from research. Systematic reviews establish whether scientific findings are consistent and can be generalized across populations and treatment variations. Systematic reviews benefit the provider by efficiently integrating large amounts of information in the literature and providing data for decision-making and treatment recommendations. Patients can utilize the data from systematic reviews to evaluate the "bottom line" of evidence pertaining to

their condition. Systematic reviews objectively summarize large amounts of information, identify gaps in research, and describe beneficial or harmful treatment interventions.⁷ The explicit nature of systematic reviews limit bias and improve reliability of recommendations.⁸

Research

The practitioner reads and interprets the scientific literature with a critical eye to determine the usefulness and applicability of the research to a clinical practice. The types of research providing the evidence are important when assessing the evidence and developing practice guidelines. Sackett describes four primary types of studies that are used in the hierarchy of evidence.⁹ The randomized control trial is the strongest evidence that can be obtained about cause and effect. This trial provides particularly strong evidence when the subjects, researchers, and evaluators are blinded to the study groups. In a cohort study part of the group (cohort) receives the treatment of interest, and part of the group does not. The groups are followed and adverse events that occur to each group are recorded. The case-control study selects a group of patients who already suffered the adverse outcome that is being studied. Another group who did not suffer the event are chosen as "controls." The researchers compare the adverse outcomes with the treatment and determine if there is evidence to support

their association. The case-series involves one group of patients about whom a researcher reports while describing a particular untoward event that occurred to one or more members of the group. Case-series studies are best used to encourage further research using stronger study designs.

Randomized control trials are expensive and time consuming. There are few randomized control trials in dentistry; and most of the trials that are available are in areas of prevention. There are other means by which evidence is obtained. One method used by the National Institutes of Health to obtain evidence and provide information for clinical practice is the Consensus Development Conference. The conference aims to bring research findings from scientific experts to the attention of the health professions. Consensus opinion from experts provides evidence for certain treatment procedures or diagnostic measures. The American Medical Association and the Institute of Medicine have acknowledged professional consensus as a broadly defined method for developing practice protocols.¹⁰ Clinicians are the ones to implement a protocol. By enabling them to develop the protocol, a guideline is more likely to be implemented. Another method is the RAND approach that brings together a panel of clinical experts to evaluate or provide their expertise to a problem being studied. In all of the approaches, the goal is to improve quality of care and outcomes.¹¹ Case reports also influence

clinical practice. These reports are discussions or reviews of treatment interventions that have demonstrated an outcome that may or may not have been the expected result from the procedure.

Although professional consensus and case reports form the basis for most of the decision-making in clinical dental care, all levels of evidence are important in developing practice protocols. Since there are no controls and because patients can present with a variety of confounding factors, consensus opinion, expert panels and case reports have inherent weaknesses. Additionally, these approaches are likely to include accepted practices for which outcomes have not been conclusively reported in the literature.¹²

The evidence provides clinicians information upon which to base their treatment decisions and assists patients in choosing between their options. Evidence-based care provides a framework for integrating good science with clinical judgment to ensure clinical practice leads to improved outcomes

VARIATIONS IN TREATMENT

The issue of variation in health care is not new. In a 1972 article, Wennberg discussed the variation in rural Vermont of various medical practices.¹³ He found that there was considerable variation within the catchment areas of the state regarding the types of surgical procedures performed and utilization rates for physician services and hospital beds. Overall, he noted a significant variation in expenditures, resources and utilization in health care delivery. Similarly, variations in health care are identified across regions of the United States.¹⁴ Wennberg's research team found that the rate of coronary artery bypass grafting among Medicare patients was more than four times higher in the Joliet, Illinois hospital referral region than in the Grand Junction, Colorado region. The rate for the procedure in Lubbock, Texas was twice as high as in Albuquerque, even though the referral regions were contiguous.¹⁵ Some variation is due to illness or disease that may be a result of environmental conditions. It is understandable that there would be more treatment for skin cancer in the South where there is a long-term exposure to the sun. For most conditions, however, a certain degree of variation may be attributed to uncertainty among professional

providers. By reducing uncertainty in clinical decision-making, it is possible to reduce unnecessary variation.¹⁶

There is considerable variability among dentists regarding both diagnosis and treatment of common clinical problems. There is disagreement on what conditions constitute a need for treatment, as well as what treatment should be performed when there is agreement that the condition warrants intervention.¹⁷ Studies show that the determination of when to treat a tooth varies considerably even among dentists on the same faculty at the same dental school.¹⁸ There is variation across the United States on managing a complex restoration on a single posterior tooth. Significant differences exist among age groups, and in different parts of the country regarding the placement of a crown versus direct restoration of these teeth. This variation could represent either over or under-utilization of crowns, neither of which is desirable and could lead to unnecessary treatment and significant inappropriate commitment of resources.¹⁹

The Clinical Diagnosis

Clinical judgment is derived largely from education, practice experience, consensus, and individual opinion. Appropriate decisions come from good clinical judgment that is based on a sound scientific foundation.

Dawson and Makinson discuss the amount of restorative care that is provided when a patient changes dentists. They cite a study conducted in Scotland in which the dental treatment needs of a population were followed over a five-year period. During this time, patients who changed their dentist received almost twice as much restorative care as those who stayed with the same dentist.²⁰ Nuttal and Elderton concluded that dentists are much more likely to recommend restoration replacement when dentists other than themselves placed the original restoration. They studied fifteen dentists who examined a group of eighteen young adult patients. The dentists planned to restore a total of between 20 and 153 tooth surfaces for the combined group of patients. There were just two tooth surfaces that the fifteen clinicians unanimously agreed needed to be restored. This study noted that of the teeth recommended for restorations, 54 percent related to replacing existing restorations. In forty percent of these cases, there was no evidence of recurrent decay.²¹ In a study on the placement and replacement of restorations reported on service members in Canada, approximately fifty percent of the restorative dentistry was the replacement of existing restorations.²²

Variation in a Military Dental Practice

The cycle of restoration replacement has implications in a military practice where a patient rarely sees the same provider from one appointment to the next. Variation in treatment occurs at different levels. At the provider level, variation occurs in a system with over 1000 dental officers from dental schools across the country. Experiences vary from one school to another and the graduate enters active duty with varying levels of knowledge of oral disease, diagnostic skill and technical expertise. At the practice level, there is variation due to the staffing of the facility. A large dental clinic with all the various specialists can provide a different level of care than a small clinic with primary care providers. Another aspect of variation is the desire of the patient. The patient has legitimate desires and opinions on the care and treatment options. A patient may be reluctant to consent to surgery for asymptomatic third molars. Another soldier may desire a crown instead of a direct restoration; or yet another inquires about a single-tooth implant instead of a fixed partial denture. What scientific evidence is available to recommend one treatment or another? Which treatment best provides the desirable outcome?

Data was obtained from the Army's Dental Workload Reporting System for fiscal year 1997 (table 1) on crowns, onlays and large amalgam restorations provided to active duty soldiers at seven

Army installations. The sites chosen were selected because the age of the patient population is similar. A large percentage of the soldiers assigned are enlisted soldiers undergoing initial entry or advanced individual training. All locations except Fort Jackson are also sites for officer basic and advanced course instruction. The data analysis shows significant variation in the crown ratio at the seven training posts.

The crown ratio is defined as the number of single crowns, $\frac{3}{4}$ crowns and onlays placed in relation to the total number of crowns, $\frac{3}{4}$ crowns, onlays and four or more surface amalgams. A crown ratio of .24 indicates that a cast restoration was placed for approximately every three large amalgam restorations. A

Installation	(a) Number of Crowns, onlays and $\frac{3}{4}$ crowns	(b) Number of 4 surface or greater amalgams	(c) Crown Ratio (c)=(a) / (a)+(b)
Ft Sill, OK	376	1180	.24
Ft Huachuca, AZ	222	353	.38
Ft Jackson, SC	675	596	.53
Ft Leonard Wood, MO	550	571	.49
Aberdeen Proving Ground, MD	289	399	.42
Ft Eustis, VA	495	499	.50
Ft Lee, VA	209	208	.50
TOTAL	2817	3806	.43

Table 1 FY 97 Dental Workload Reporting System (DWRS) data by installation for crowns, onlays, $\frac{3}{4}$ crowns and 4 or more surface amalgams for active duty soldiers.

crown ratio of .50 indicates a crown, $\frac{3}{4}$ crown, or onlay was placed for each amalgam restoration of four or more surfaces. The review of this data shows some dental treatment facilities

place cast restorations at a rate three times greater than at other sites. Guidelines, particularly those based on scientific evidence, can reduce variation and improve consistency in clinical decision-making.

GUIDELINE DEVELOPMENT

Often referred to as practice protocols or parameters, guidelines provide clinicians and consumers with information that enables them to make the best possible decisions based on scientific evidence and clinical information. Guidelines can originate in one of two ways. They can be consensus-based or evidence-based. Ideally, guidelines should be based on good scientific evidence obtained from accepted research protocols. However, until there is a science base for certain topics or areas of clinical practice, consensus-based guidelines can assist clinicians in treatment planning, provide essential information for patients to be informed consumers of health care, and reduce practice variation due to uncertainty. The Institute of Medicine in 1990 described practice guidelines as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances."²³ Eddy describes practice policies or clinical guidelines as performed recommendations issued to influence decisions about health interventions.²⁴

Guidelines in Dentistry

Guidelines are not new to dentistry. Various professional organizations publish guidelines that provide clinicians a

pathway for treating certain conditions. Three principle entities are the agents for guideline publication.²⁵ Government agencies, professional groups and non-profit organizations all have an interest in the publication and dissemination of guidelines. The Food and Drug Administration published guidelines in 1988, which were later endorsed by the American Dental Association, to help reduce the amount of dental x-ray exposure to patients without risking quality of care.²⁶ The American Dental Association Council on Access, Prevention and Interprofessional Relations provides guidelines on fluoride supplementation based on the level of community water fluoridation.²⁷ Dentists are familiar with the guidelines developed by the American Heart Association on antibiotic prophylaxis for bacterial endocarditis.²⁸ These guidelines assist clinicians and patients in making decisions about treatment, diagnostic tests and risk management.

A significant amount of literature in recent years discusses minimum intervention or "preservative treatment" in dentistry.²⁹ This philosophy underscores the fact that a dental restoration is not as desirable as a sound tooth. A dental restoration is likely to eventually fail and need to be replaced. Various approaches can be combined to conserve tooth structure include adopting the methods of primary prevention, remineralization and minimal intervention. Guidelines that

consider these approaches can result in a shift of resources from those dedicated to operative intervention to resources committed to preservation.

Prevention

Preventive interventions include fluoride, sealants, chemotherapeutic agents and dietary counseling. Ishmail and Lewis systematically reviewed the evidence supporting various modalities to prevent dental caries. They published their recommendations for guidelines for dental caries prevention in 1995.³⁰ Their recommendations on managing caries detail prevention methods including fluoride, pit-and-fissure sealants, oral hygiene measures and dietary counseling. They provide the clinician and patient strong justification for specific interventions. Similarly, they reported on periodontal disease and provided guidelines based on levels of evidence.³¹ Their study discussed classification, diagnosis, risk factors and prevention for periodontal diseases. The recommendations were based on research that included clinical trials, cohort studies and cross-sectional studies. Ishmail and Lewis noted that there is no evidence to support a regular biannual or annual scaling in periodontally healthy patients. Proper diagnosis and risk assessment of these patients would reduce the cost of care for periodontal disease and shift resources and professional time to

those patients who require treatment due to severe periodontal disease.

Remineralization

The incipient or non-cavitated lesion which is frequently seen as a white or brown spot during a clinical examination may appear radiographically as an interproximal radiolucency that has not crossed the dentino-enamel junction. These lesions may be reversible and have the potential to remineralize,³² or already have done so. The constant process of inorganic salts moving out of or into the tooth results in demineralization and remineralization. Exposure to fluoride fosters a series of re-precipitation occurrences. Calcium, phosphate and bicarbonate from saliva re-precipitate and re-form apatitic salts under mildly alkaline conditions of increased salivary flow rates.³³ Fluoride available from fluoridated water or toothpaste enhances remineralization in the early caries process resulting in remodeled enamel that is less caries prone (Dr. John Brown, University of Texas at San Antonio, personal communication, May 1998). Fluoride also inhibits glycolysis, potentially reducing the acid available to initiate demineralization.³⁴ Remineralization therapy is recommended on all non-cavitated lesions and standardized protocols are recommended to accurately diagnose dental caries, assess caries risk, monitor lesion

status, arrest active caries and remineralize non-cavitated lesions.³⁵

Caries Risk Assessment Protocol

Advances in research, better technologies, improved methods and procedures, and cost control pressures are some of the factors that make decision-making increasingly complex in medicine and dentistry.³⁶ A risk assessment protocol (table 2) for caries management can assist the practitioner and patient in determining appropriate clinical therapy for dental caries.³⁷ Individuals at low risk for caries who present with few incipient lesions can be managed with a remineralization treatment protocol that includes sealants for uncoalesced pits and fissures, dietary counseling and the application of topical fluoride. Patients at moderate risk for caries are those with one or two cavitated lesions. These individuals require restoration of the cavitated lesions and concurrently are provided a remineralization regimen similar to the low risk patient. They can be recalled every three months at which time their treatment regimen is modified based on caries experience.

Patients with three or more cavitated lesions are at high risk for dental caries and require more aggressive treatment. Lesions with frank cavitation are removed and restored to form and function. Once the operative treatment is completed, the patient is managed with pit and fissure sealants, fluoride

Patient Risk	Treatment Regimen
<p style="text-align: center;">LOW</p> <p style="text-align: center;">Few incipient lesions</p>	<p style="text-align: center;"><u>Remineralization Regimen</u></p> <ol style="list-style-type: none"> 1. Seal uncoalesced pits & fissures 2. Diet survey & modification 3. Evaluate salivary flow 4. Reinforce oral hygiene 5. Professionally applied fluoride 6. Home fluoride (rinses & dentifrice) <p style="text-align: center;"><u>6 month recall</u></p> <ol style="list-style-type: none"> 1. BW x-rays & monitor lesions 2. Verify sealant retention 3. Continue home fluorides 4. Modify as necessary, e.g. chlorhexidine
<p style="text-align: center;">MODERATE</p> <p style="text-align: center;">One or two cavitated lesions</p>	<p style="text-align: center;"><u>Treatment & remineralization regime</u></p> <ol style="list-style-type: none"> 1. Restore cavitated lesions 2. Seal remaining pits and fissures 3. Diet survey & modify as needed 4. Evaluate salivary flow 5. Professionally applied fluorides 6. Reinforce hygiene 7. Home fluorides 8. Xylitol chewing gum 9. Chlorhexidine rinse <p style="text-align: center;"><u>3 month recall</u></p> <ol style="list-style-type: none"> 1. Verify sealant retention 2. Reinforce diet modification, oral hygiene, fluorides, xylitol gum 3. Modify as necessary (e.g. professionally applied fluoride, fluoride varnish, saliva substitute)
<p style="text-align: center;">HIGH</p> <p style="text-align: center;">Three or more cavitated lesions</p>	<p style="text-align: center;"><u>Treatment & remineralization regimen</u></p> <ol style="list-style-type: none"> 1. Restore cavitated lesions 2. Seal remaining pits and fissures 3. Diet survey & modify as needed 4. Evaluate salivary flow 5. Professionally applied fluoride 6. Fabricate home fluoride trays (1.1% neutral NaF) 7. Reinforce hygiene 8. Xylitol chewing gum 9. Chlorhexidine rinse <p style="text-align: center;"><u>3 month recall</u></p> <ol style="list-style-type: none"> 1. Verify sealant retention 2. Reinforce diet modification, oral hygiene, fluorides & xylitol gum 3. Modify as necessary (e.g. professionally applied fluoride, fluoride varnish, saliva substitute)

Table 2 Risk Assessment Approach for Caries Management

Source: Navy Dental School, Naval Medical Center, Bethesda, MD (with modification)

rinses, dietary counseling, and other preventive regimens. These individuals are recalled every three months. Their oral hygiene is evaluated and modifications are made as necessary. Fluoride varnishes may be applied, especially for those less compliant in the use of home fluorides, and diet modification may be recommended.

The goals of a caries risk assessment protocol are reduction in caries activity, appropriate intensity of preventive care, fewer restorations and a lifetime of improved dental health for the patient. A caries risk assessment protocol emphasizes preventive care that considers the ability of the incipient lesion to remineralize in the proper environment. This approach to caries management enables the dental team and patient to work together to achieve success outcomes in oral health care. The strength of evidence in the protocol relies on the systematic review of the literature conducted in the areas of caries prevention. While the protocol itself has not been applied to large-scale populations, various recommendations within the caries risk assessment protocol have a scientific basis that has proven to be effective in well-designed randomized controlled trials.

Restoration and Replacement

Each military service member is required to report for an annual dental examination³⁸ and is classified to determine their

oral health readiness for deployment.³⁹ One of the desired outcomes from this examination and treatment is that the soldier will not develop a preventable dental emergency within twelve months.

In 1994, the Tri-Service Center for Oral Health Studies published a report on the dental needs of a service member over a twenty-year career.⁴⁰ It demonstrated that when a soldier first enters active duty, most of the dental treatment needs are restorative dentistry and oral surgery. After initial operative dentistry, the restorative needs taper off and remain constant throughout the career. Although not addressed in the survey, it is likely that a large percentage of the restorative dentistry was replacement of existing restorations. The survey showed that requirements for prosthodontic and periodontic treatment rise near the midpoint of service and peak shortly before retirement.

The cycle of restorations that was described by Nuttal, Elderton and others is evident in the dental treatment of a service member over a twenty-year career. Each year the soldier has an annual dental examination and is provided a treatment plan. If required, a follow-up appointment is scheduled that may or may not be with the same dentist who performed the initial examination. The succeeding dentist may modify the treatment plan depending on his interpretation of the clinical

findings, radiographs, and his own clinical experience. Each examination places the existing restorations in jeopardy. In a recent editorial on the survival of amalgam restorations, two experts comment that "the most dangerous time for an amalgam restoration may be when it is seen by a dentist, especially when the patient is seeing the dentist for the first time."⁴¹

As the soldier moves to different assignments in his career, he sees different providers with slightly different approaches to caries management. Restorations are evaluated and some are replaced, with the new restoration slightly larger than its predecessor. At another examination, a decision may need to be made about clinical or radiographic evidence in consideration of a pending deployment to a remote location. While it may be uncertain as to the significance of a slight marginal discrepancy or an incipient lesion noted on a radiograph, neither the dentist nor the patient wants to take a chance at having a problem occur at a location far from dental support. Once again, the restoration is removed and replaced. Has a dental emergency been prevented, or is the tooth now more susceptible to fracture or irreversible pulp changes?

At some point, the examining dentist may recommend a crown for the tooth because of the extensive nature of the alloy or resin restoration. The tooth that was diagnosed early in the career with possible caries has now been re-restored until the

final restoration is a cast crown. The treatment plan may also include crown lengthening and endodontics to provide adequate tooth structure for support of the restoration.

Guidelines for the treatment of the non-cavitated carious lesion and the prevention of dental caries can limit the initiation of the first restoration. The dental care delivery system that consistently emphasizes an approach based on minimum intervention, proven methods of prevention, and remineralization therapy can result in improved outcomes and increase soldier dental readiness in a military practice.

DENTAL CARE REENGINEERING INITIATIVE

The Army Dental Care Reengineering Initiative (DCRI) is a patient-centered approach that places high priority on prevention of disease and preservation of health.⁴² A dentist is designated the primary care manager for a population of soldiers. The DCRI team also includes a hygienist, two dental assistants, and other ancillary personnel. By assigning soldiers to a primary care manager, variation in providers is reduced. The team provides general dentistry services, oral hygiene instructions, individual counseling, and fluoride applications as part of the oral health prevention program. Working closely with the medical clinic, the DCRI team engages in a cooperative effort to manage the overall health of the soldier. This may include nutritional counseling, smoking cessation, sealants, mouthguard fabrication and hypertension screening.

Implications of Protocols on a Military Practice

Variation in treatment can result in expenditure of significant resources. Neither over-utilization or under-utilization is desirable. Guidelines that are based on the best evidence can reduce variation and increase appropriateness of care. The patient-centered approach to wellness and health

promotion that encompasses an evidence-based approach can reduce the need for restorative dentistry for the incipient lesion. Management of the non-cavitated lesion through a caries risk assessment protocol by the DCRI team may also influence clinic staffing ratios. Since there will be less restorative dentistry required, the dentist can delegate more responsibility to the ancillary personnel. The ancillary staff can provide necessary counseling, administer appropriate fluoride therapies and discuss aspects of oral hygiene.

Frequently performed procedures are other areas in which guidelines are appropriate in a military practice. Potential topics for practice protocols include management of edentulous spaces, periodontal disease management, the complex restoration on a posterior tooth, management of asymptomatic third molars; and the annual dental prophylaxis. Guidelines can minimize variation among providers in treating these clinical problems and potentially shift resources to other areas in the Army Dental Care System in which treatment needs are greater.

Areas for Future Research

Controlled trials provide the best evidence for clinicians to base their treatment decisions. Implants have become the standard practice among many prosthodontists and general dentists. Outcomes research comparing the survivability of an implant with a fixed partial denture could provide useful

information for patients, providers and policy makers. When it is possible to place an implant, it is conceivable that the benefits of a single tooth implant far outweigh those of a fixed partial denture. An implant preserves the health of the adjacent teeth, promotes better periodontal health around the restoration, and does not jeopardize the pulpal tissues since the adjacent teeth are left unprepared. While the initial costs may be more for the implant, cost effectiveness studies may show that the long-term costs associated with possible re-treatment, endodontics, and periodontics associated with the fixed partial denture actually exceed the costs of a single tooth implant.

The survey of crowns and large amalgam restorations at seven Army installations demonstrates significant variation among similar populations. There is still a lack of scientific evidence regarding when a crown should be the restoration of choice for a compromised posterior tooth. Outcome studies are required to compare the benefits of the cast restoration with that of the direct alloy or resin. A full coverage cast restoration requires considerable time on the part of the patient, dentist and laboratory staff. A cast restoration may provide protection from tooth fracture, but equally unknown is the degree to which the procedure increases the risks of other health problems such as pulpal changes and periodontal inflammation.

CONCLUSION

A protocol-based approach has broad implications for dental healthcare programs in the military services. A patient-centered, wellness and health promotion program incorporating a caries risk assessment protocol can reduce the initial surgical restorative dentistry treatment. By minimizing the operative needs initially, the long-term benefits include replacing fewer restorations over a career in the military service. An approach that involves "minimum intervention" to treat incipient dental caries may enable the Army Dental Care System to shift resources to other areas of the dental support mission. The adoption of consensus-based guidelines in areas of dental practice can assist practitioners and patients in clinical decision-making.

As the concept of evidence-based dentistry becomes more universally accepted, dental educators, professional organizations and others will likely identify topics for research. These studies should be directed toward obtaining evidence that provides a scientific basis for clinical decision-making. The Agency for Health Care Policy and Research has the resources and expertise to play a significant role in evidence-based care. Providers, patients, professional organizations,

health plans, government agencies, and employers all have an interest in improved outcomes and increased quality of care.

The military health system provides an ideal environment for studying, drafting and implementing guidelines and can lead the nation in demonstrating their effectiveness. In dentistry, where there is variation in diagnosis and treatment planning among providers, protocols provide a base of reference for clinical judgment. Evidence-based guidelines developed from systematic review of scientific research and integrated with sound clinical judgment can reduce variation in treatment and lead to consistently better outcomes.

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