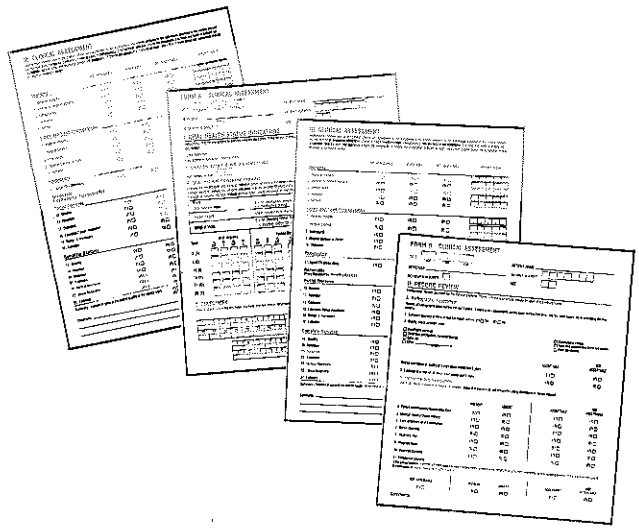
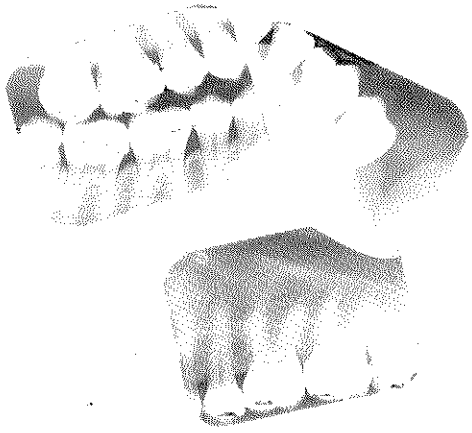
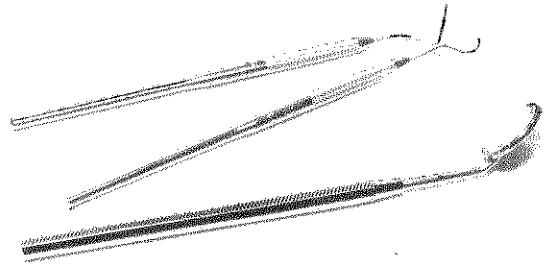
A Comprehensive Quality Assurance System for Practicing Dentists



A Clinical Outcomes Management Approach





(1) ☑ Excellent (2) ☐ Good

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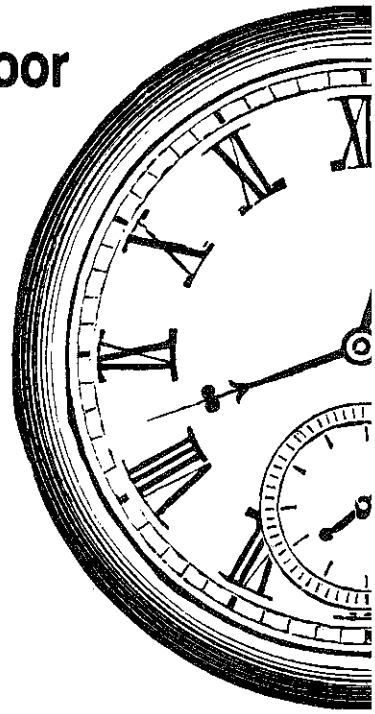

Neal A Demby, DMD, MPH
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Mary Angello, PhD

A Comprehensive Quality Assurance System for Practicing Dentists

A Clinical Outcomes Management Approach

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A Comprehensive Quality Assurance System for Practicing Dentists

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Preface

This is the first of what will be a series of publications by the Clinical Directors Network of Region II, Inc. Naturally there are many individuals who made this publication possible. Dr. David Stevens must be mentioned for his vision and leadership capability in founding The Clinical Directors Network several years ago. The Association of Region II Community Health Center Dental Directors, since its founding over 18 years ago, has assumed leadership in pursuing quality assurance activies when they were a mere flicker in the eyes of the rest of the profession. The ongoing guidance, support and at times prodding of the United States Public Health Service Regional Dental Consultant, Dr. Jan Richard Goldsmith, has been extraordinary. He has served as a source of light and strength over the past decade and a half in accomplishing this effort. The late Dr. Vivian Chang, Regional Health Administrator and Dr. Gilberto Cardona, Chief of the Clinical Services Section, Region II United States Public Health Service, have been constant advocates of quality assurance activities, and their support in bringing this publication to fruition is greatly appreciated.

Most importantly, this revision would not have been possible without the writing, input, review and overall dedication of Dr. Juris Svarcbergs and Dr. Georgina Zabos. We have all been alter egos to one another.

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November 1990

Introduction

We are witnessing the early stages of a revolution in the way American health care providers practice their art and science. It is not a revolution of the kind of work they do, but of under whose auspices and in what company they do it.[1] The changes surround us and can best be described as the:

- rapid, competitive corporatization of practice
- increased reliance and use of medical technology
- increased and new uses of information systems[2]

Among the precipitating causes for this transformation of the health care system are the spiraling costs of health care consuming an ever increasing percentage of our Gross National Product (GNP) and the consequences of strategies (cost containment and quality assurance) designed to contain them. Strategies designed to contain costs, such as Diagnostic Related Groups (DRG's), managed care, and quality assurance activities, have reaped far-reaching and, at times, unintended consequences. Recent increases in the supply of medical/dental manpower, and a continuous parade of new technology with an imperative to use it, have also had a broad impact.[1]

Because decisions being made in corporate practices revolve around controlling costs while still assuring quality, medical practice is now more commercial, competitive and corporatized, with more and more of the doctor's decision making process being standardized and monitored. As practice comes under corporate control in its varying shapes and forms, the doctor becomes an employee and the doctor/patient relationship responds to corporate interests. Information systems monitor the doctor's work and as a consequence it becomes more standardized and prescribed.[3] Through this process the ultimate balance of quality and cost may be possible. The prevailing concept of professional dominance and the medical profession's long campaign for autonomy is thus reversed.[4,5]

Dentistry, though at a somewhat slower pace, is subject to the same concerns and issues as medicine. The centerpiece to controlling costs and addressing the multiple issues confronting the health care system hinges on our ability to incorporate satisfactory quality assurance methodologies and outcome management strategies into everyday practice.[6]

Since the Demby, Rosenthal quality assurance system was developed in the early 1970's, it has undergone several revisions—the last being in 1980.[7,8] During the past decade, the system has been utilized to evaluate the quality of dental care in almost every imaginable practice configuration including private and group practices, community health centers, hospital dental services, managed care or HMO settings, nursing homes, and other institutional settings.

In addition, the system was developed to assess the full spectrum of clinicians—ranging from dental students and residents, to salaried and privately practicing dentists. Because of its comprehensive nature, commitment to ongoing provider feedback and education, ease of usage, and outcome management approach, this quality assessment and assurance system can accommodate itself to incorporation within a wide variety of private, institutional and corporate configurations, as well as lend itself to use by a diverse range of providers.

The revisions herein were necessitated because the health care system is confronted with concerns today that were less significant a decade ago. The nature of quality assurance activities must be dynamic and evolutionary in order to confront

these issues which include risk management; the malpractice crisis; AIDS; infection control and compliance with Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations; impaired physician/dentist problems; and the integration of new research and technologies into dental practice.

If one were to define quality assurance in its broadest scope, the spectre of quality assurance activities would impinge upon the practicing dentist at almost every career level and passage. Table I lists the broad spectrum and potential levels of quality assurance assessment activities that might impact upon the practicing dentist throughout his/her career. The length of time and number of quality assurance activities to which each dentist is exposed is in part determined by the practice setting chosen. Of particular note is that each of the quality assessment/assurance activities in Table I is inextricably entwined by the tenets of professional ethics. While it is not the intent of this publication to explore each of these levels, it is clear that this quality assurance system is capable of achieving a comprehensive assessment of quality at multiple levels.

Importantly, the orientation of this quality assurance system has been and continues to be towards outcomes management. It is in keeping with the dynamic changes sweeping medical and dental care that Dr. Arnold Relman labeled "a new era of assessment and accountability."[9] There is significant impetus for the incorporation of health outcome strategies into our monitoring systems today. Berwick has espoused the theory of continuous improvement as an ideal in health care, and indeed, the quality assurance system herein, speaks strongly for and solidifies that ideal.[10] The Joint Commission on Accreditation of Healthcare Organizations (JCAHO), in their agenda for change, is successfully incorporating outcome elements and clinical and managerial indicators within their accreditation processes.[11] In concert with JCAHO objectives, Benson has developed a quality audit system for achieving excellence in ambulatory and primary care activities.[12,13] Certain patient outcomes, such as functional status and quality of life may allow for maximum comprehensiveness in assessing the quality of care according to Greenfield.[14] These and the interpersonal aspects of office care—the caring phenomenon—may also impact significantly on patient outcomes.[15]

Elwood has proposed outcomes management as a technology of patient experience designed to help patients, payers and providers make rational care related choices based on better insight into the effect of these choices on the patient's life. Outcomes management has four basic components:

(1) It places reliance on standards and guidelines that providers utilize in prescribing treatment;

(2) it measures in a systematic way the functional status of patients;

(3) it pools clinical and outcome data on a large scale;

(4) it attempts to analyze and disseminate results from the data base to each decision maker. In a sense outcomes management's closest relative is the clinical trial—however this would be a clinical trial that would never stop and be subject to modification based on the results of analysis and feedback.[6]

Lastly, the National Medical Outcomes Study (still in progress) attempts to assess the quality of life using measures of function and well-being developed by Greenfield and Ware.[15,16]

The dental quality assurance system within this book draws on pieces from each of the outcome-based approaches just reviewed and is, in a broad sense, a composite of many of these methodologies. It is a system that is based on explicit criteria, standards and guidelines; it is patient-oriented; it is concerned with the functional status and well being of patients; it is user friendly; it provides ongoing feedback to providers and monitors changes in their practice patterns; it utilizes educational interventions; and it is a system developed by and for dentists.

Significantly, this system utilizes a managed care and case management approach to the evaluation of dental services. Conceptually, managed care seeks to allocate and utilize scarce resources in the most effective and efficient manner, including an appropriate mix of providers, patients and services; in order to achieve the maximum impact on functional health status outcomes and patient satisfaction, for the individual, family and community. Equivocally, perhaps, according to some, outcomes management relies heavily upon and stresses the principles of managed care and case management to satisfy its objectives.

The system herein stresses to providers who utilize it the necessity to assess:

- Effectiveness, efficiency and continuity in all aspects of the provision of care
- Underutilization and overutilization of services
- Logical, sequential treatment planning processes in case management
- Case management that stresses the integration of patient education, levels of prevention, medical management, psychosocial/lifestyle issues—in the overall quality of clinical services provided.

This approach, when understood and utilized by the dental team, ought to assure more positive functional dental health status outcomes and greater patient satisfaction in the future. The potential for more effective and efficient resource utilization may be realized if this and other quality review systems can be incorporated into clinical practice.

In revising the Sunset Park/Demby, Rosenthal quality assurance system, emphasis was directed toward the following areas:

Incorporation of an outcomes management approach

Incorporation of more explicit and state of the art criteria to assess radiographs

Inclusion of more explicit criteria in the record assessment profile in keeping with concerns over risk management and professional liability

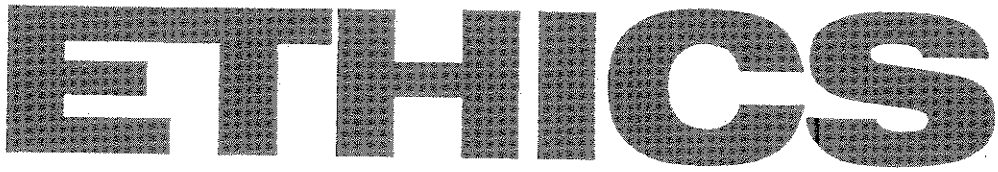
Inclusion of more explicit preventive criteria, particularly regarding sealant application and periodontal treatment; as well as use of the U.S. Preventive Services Task Force Guide to Clinical Preventive Services in the areas of caries, periodontal disease, trauma, malocclusion and oral cancer

Development of comprehensive Infection Control Assessment including Hazard Communication and Infectious Waste Disposal criteria

Table I

The Broad Spectrum and Potential Levels of Quality Assurance Activities that Might Encompass the Practicing Dentist Throughout a Career in Dentistry.

- Malpractice
- Relicensure
- Public & Private sector initiatives in developing quality assurance methodologies; outcomes management
- Institutional review; Professional Review Organizations (PRO) Diagnostic related groups (DRGS)
- Corporatization of Practice
- Marketing Strategies (internal and external)
- ADA/Promulgation of standards via various councils and commissions
- ADA/Principles of Ethics and Code of Professional Conduct
- Institutional Certification
- JCAHO (Joint Commission on Accreditation of Healthcare Organizations)
- Continuing Education
- 3rd parties; claims review
- Profile Analysis
- Medicaid and Medicare; DRG's
- Physician Payment Review Commission.
- Organizational trends; Group; Prepaid; HMO; PPO's; IPA's; Managed Care
- CDC; OSHA; EPA Infection Control and other Regulations
- Consumer Activities/Membership on state boards and insurance commissions
- Patient Satisfaction/Functional Health Status Measures
- ADA/Office of Quality Assurance
- Component Society/Peer Review Committee



- Commission on Accreditation (ADA)
- Hospital admitting privileges
- Board eligibility and certification; Residency training programs
- Fellowship examinations (AGD)
- Accreditation of dental schools, commission on accreditation (criteria & standards)
- Prescreening of applicants before accepted to dental school
- Impaired Dentist Programs
- State Regulatory Agencies for health care
- Certificate of Need (CON)
- Legislation
- Federal Legislation/Health care quality improvement act
- National Practitioner Data Bank
- Credentialling mechanisms
- Certification
- Licensure
- State Board of Dental Examiners/State Board Exams
- Regional Boards
- State Education Department
- Dental School Curriculum Integration of clinical and didactic components of quality assurance activities into curriculum
- National Board Examinations I & II
- Development of quality assurance curriculum for dental schools
- Dental Aptitude Testing

Updating of the annotated bibliography to include significant technology and research achievements

Incorporation of a managed care and case management approach to dental service evaluation

These revisions, as have previous ones, make the quality assurance process more comprehensive, more explicit and more quantifiable. With these revisions in place this quality assurance system and book will serve as a more valuable resource in assuring the quality of dental care. The system may be used as a self-assessment tool or as part of an ongoing internal/external quality assurance system. It is for use by dentists and administrators of dental programs and if used as indicated, can serve as a large part of programmatic evaluation. Its use is encouraged in all practice configurations, be they institutional, public, private or corporate.

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Section I *Background*

Various methodologies exist and have been utilized to evaluate the quality of dental services. Most quality assurance systems to date have been developed in institutional settings with their use confined therein.[1-14]

Of the existing systems the majority have been geared solely toward evaluating the quality of dental restorations rather than assessing treatment planning, oral health status indicators or outcome measures. Little work or effort has been directed toward developing a quality assurance system that is:

- Able to assess multiple parameters of care, e.g. oral health status indicators, records and radiographs, clinical quality, case management and treatment planning, and patient satisfaction
- Largely outcome-oriented
- Reliant on utilization of both explicit and implicit approaches
- Both an assessment and assurance of quality of care
- Transferable between various practice configurations—public, private or corporate

In April 1978 the American Dental Association completed a state of the art study of dental quality assurance under a contract to the United States Department of Health, Education and Welfare in an effort to identify systems of ongoing evaluation in dentistry.[1] In the course of the study the quality assurance system developed at the Sunset Park Family Health Center of Lutheran Medical Center in Brooklyn, N.Y. was singled out as one of the nine systems to be examined thoroughly via site visit. This program was fully documented, reviewed by nearly 30 consultants representing all dental specialties and experts in the field of quality assurance and rated against a model of 100 characteristics of quality assurance programs.

The Sunset Park Quality Assurance Program was selected as one of three methods recommended to the Department of Health and Human Services for field testing and potential use in the private sector. The comprehensive nature of this program assessed the process of patient care through both direct clinical evaluation and record review, and utilized service profiles to evaluate the appropriateness of care.

In 1979, the Lutheran Medical Center received funds from the W. K. Kellogg Foundation through the National Dental Quality Assurance Program of the American Fund for Dental Health to implement and test, in private dental practices, the dental quality assurance system developed at the Sunset Park Family Health Center.

The major objectives of this project were as follows:

- To determine the relationship of utilization profiles (indirect method) obtained from service data and quality of care profiles (direct method) obtained from patient audits
- To determine if data on profiles can serve as indicators or predictors of quality and a method to focus on possible problems
- To examine the influence ongoing feedback using profiles on patterns of practice has on practitioner behavior
- To monitor the costs of utilization analysis, and clinical audit in both time and dollars.
- To develop a model for measuring dental care based on criteria weighting.

These objectives were successfully accomplished. In particular it was established that the use of ongoing feedback to clinicians actually improved their quality of care and that this system could be introduced and utilized at reasonable cost with significant benefits.[10] This is in accordance with the results of Eisenberg, that if given detailed accurate information reflecting the quality of care they provide, physicians can and do modify their behavior to improve patient care.[15] The American Fund for Dental Health (AFDH)/W. K. Kellogg-funded National Dental Quality Assurance Program, through its efforts over the past few years, has served to advance the state of the art of dental quality assurance research activities. The need for a quality assurance methodology that was both comprehensive and easily transferable from a research setting to public and private sector use had been addressed by this project. The Quality Assurance Manual and methodology that was developed as part of the AFDH/W. K. Kellogg effort possesses characteristics that fulfill the aforementioned deficiencies and that make this system particularly attractive for use by all of dentistry. The characteristics are as follows:

A systematic sequential approach is defined that should prove easily transferable to practice settings, be they public, private or corporate

Multiple levels of care are evaluated

Explicit and implicit methods are utilized

An outcome approach is used along with an emphasis on managed care and case management

Educational aspects are included and emphasized

Provisions for immediate feedback to dentists are built into the system

Although quality assurance methodologies are currently being utilized in many publicly funded programs, particularly community health centers, the private dental office, where the overwhelming majority of dental care in the United States is performed, has remained virtually untouched by the quality assurance phenomena.

This system through both direct and indirect quality review processes is capable of evaluating the quality of care in public, private or corporate practice environments. Table II lists the advantages and disadvantages of the direct and indirect review processes.

Table II
Advantages and Disadvantages of Direct and Indirect Review Processes

Direct Review (Clinical Assessment)

Advantages

- May be most acceptable to practicing DDS if performed by peer
- Provides immediate feedback to DDS on quality of clinical services
- Potential for marketing (recruitment and retention of patients)
- May serve as educational process in changing behavior and patterns of practice
- May be more meaningful to and be more acceptable to consumers

Disadvantages

- May be more costly
- Must rely more heavily on DDS Reviewer for acceptability to profession
- Limited number of patients can be accommodated
- May take considerable time
- Requires use of clinical facility with its loss from provision of direct patient care

Indirect Review (Record Review, Profiles, etc.)

Advantages

- May be less costly
- More readily relies on non-DDS for review process.
- Allows for screening techniques with more cases able to be reviewed
- Serves as educational process in changing behavior and patterns of practice
- Doesn't require use of clinical facilities

Disadvantages

- Feedback is often not immediate
- Relies on non DDS; may be least acceptable to profession
- Use of profile data (computer) may be more threatening to profession
- May be less acceptable to consumers

Quality assurance as defined in this system involved the following:

- Measuring quality of care according to various criteria and based on recognized standards
- Examining and identifying problems
- Acting on identified problems feedback/educational intervention
- Going back to measure the quality of care to see if changes have been made

The system is able to assess multiple parameters of care (oral health status indicators, records and radiographs, clinical quality, treatment planning, and patient satisfaction) and is largely outcome-oriented. The methodology further relies on utilization of both explicit and implicit approaches to assess and assure the quality of care. Since its development, this quality assurance system has been used extensively and successfully in various types of practice settings including solo and group practices, hospital dental services, residency training programs, community health centers, managed care and HMO programs, and National Health Service Corps sites. It offers these distinct advantages:

Ease of transferability between practice settings

Reasonable cost

Ease of training reviewers

Outcome orientation, combining both explicit and implicit approaches to review

Comprehensiveness in scope: all levels of care are assessed; managed care approach

Emphasis is on appropriateness of care and the treatment planning process, an area not previously stressed in quality assurance methodologies

Immediate feedback to providers is possible

Educational intervention is included and emphasized with this system

Time element per patient reviewed is short (20 minutes)

Orientation to consumer with use of Oral Disability Impact/ Patient Satisfaction Index (ODI/PSI).

The quality assurance system and manual present a unique opportunity for dentistry to assume and assure accountability at all levels.

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Overview of the Quality Assurance System

Development of Quality Assurance Manual

Development of the Quality Assurance Manual and system became one of the most critical and important outcomes of a study that focused on multiple objectives. The Quality Assurance Manual as described herein was developed to serve as a guideline for a systematic and rational approach to the audit process by reviewers. The main objectives of the manual are to define the audit process in detail and to define the criteria utilized during the audit process.

Before proceeding with a general overview of the Quality Assurance Manual and audit process, several additional points need to be mentioned:

- A two-point scale (acceptable/not acceptable) was utilized to maximize inter-examiner reliability.
- All criteria in Part I, II, III, IV, V of the audit process are defined explicitly by definition as well as by a series of photographs included in the manual.
- Most all criteria were included because nonadherence to these criteria would have had an adverse impact on the oral health status of patients. In this sense, the audit process is largely outcome-oriented, and an outcomes management approach is adopted.

Contents and Design of the Reviewer's Manual

The Manual was designed in order to permit ease of use. It is divided into three sections. The first section consists of the background and objectives of the quality assurance system, rationale and sequence of the audit process, logistics of the office visit, calibration of reviewers, conduct and responsibilities of the external reviewers, and other information. The second section of the manual consists of the audit forms (the five parts of the audit process), instructions for their use and written definitions of all criteria utilized in the audit process. In addition to written instructions for each criterion, a series of photographs is included in order to present graphically to the reviewer how each criterion should be interpreted. The third section of the manual is an annotated bibliography developed for each of the 24 clinical assessment criteria used in the audit process.

Rationale and Sequence of the Review Process

Each auditor reviewer is responsible for conducting audits at the offices of randomly assigned practitioners. Approximately 20 patients can be scheduled for each audit. In order for the audit to proceed effectively and efficiently, a standardized format is developed for each patient. The audit is divided into five parts that are performed sequentially. Each part provides pieces of information that become additive as the audit process progresses.

The auditor is trained as he or she progresses to view the audit process as an incremental step-by-step accumulation of information upon which to make more reliable and informed decisions. As the audit process unfolds from Part I to Part V, the criteria evolve from being largely explicit to more implicit criteria (Part IV). This combined approach, explicit (Part I, II, III, V) and implicit (Part IV), is favored over

favored over a totally explicit review because of its flexibility, efficiency, and acceptance by dentists with experience in quality assessment.

Explicit and implicit criteria are defined as follows:

- **Explicit criteria:** Criteria that were set, developed, or predetermined by group consensus of recognized authorities in the field.
- **Implicit criteria:** Criteria that rely on the subjective evaluation of the auditor. They are criteria that have been internalized by the individual and may differ according to the individual's knowledge, training, and experience.

The five parts of the audit process are as follows: (I) Oral Health Status Indicators, (II) Dental Record and Radiographic Assessment Criteria, (III) Clinical Assessment Criteria, (IV) Assessment of Treatment, (V) Infection Control Assessment

Part I Oral Health Status Indicators

Before any of the indices are performed, it is important that the patient answers medical history questions and the evaluator reviews the responses. The patient will be given the medical history questions at the time of registration/presentation for the audit (See page 64).

The oral hygiene index, gingival index and pocket depth will be performed *initially* on the teeth and surfaces indicated. This will be done by a registered dental hygienist or dentist reviewer depending on scheduling and time constraints. The Oral Health Status Indicators* will provide you with a picture of the present periodontal and caries status against which to look at criteria that follow. All patients you have evaluated should be receiving comprehensive care.

Part II Dental Record Assessment and Radiographic Assessment

The Dental Record Assessment and Radiographic Assessment provides indirect data based on explicit criteria to assess radiographs and dental records before moving on to look at the patient directly. This information may provide you with essential information in order to more fully comprehend the actual clinical assessment of each patient. Remember that these criteria are explicit and assessed as present/absent and as acceptable/not acceptable. As you move through the chart audit process, conduct the Radiographic Assessment *first* and then the Dental Record Assessment.

Part III Clinical Assessment

These criteria are largely explicit and also assessed as acceptable or not acceptable. In order to ensure reviewer reliability, it is essential that you become familiar with the definition of each criterion found in this manual and adhere to it strictly until it becomes internalized. **All criteria have been selected because of their potential impact on the oral health status outcome of patients**. There is ample scientific documentation to relate non compliance with most of these criteria to adverse oral health status outcomes. A bibliography reviewing the dental literature as it applies to these criteria is found in the Appendix of this manual.

**While it is desireable to utilize all oral health status indicators, those not wishing to can bypass the Oral Hygiene and Gingival indicators and only check the column labeled, "Summary: Check box if any surface is >5mm." (See Appendix A)*

Part IV Assessment of Treatment

This part integrates information previously obtained in Parts I, II, III with the ability of the dentist to manage the care of the patient with respect to each of the following:

a) Completeness of Diagnosis

b) Integration of Non Dental Considerations

c) Appropriateness of Treatment

d) Logical Sequence of Treatment

e) Patients Perception of Treatment

As you can see, these criteria depend much more on your own implicit judgment to arrive at a decision. However, guidelines for ascertaining the acceptability or unacceptability of these five areas are provided.

Part V Infection Control Assessment

This part relies on explicit criteria to assess whether the practice/facility is in compliance with recommended infection control practices for dentistry and has in place a Hazards Communication and Infectious Waste Disposal Program. These practices and criteria must be in compliance with both Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA) regulations, and Centers for Disease Control (CDC) recommendations. Remember that these criteria are explicit and defined as acceptable/not acceptable. Only *one* infection control assessment need be done per practice/facility reviewed.

Development of Criteria

Definition of Criteria

The definition of the term criteria is that adopted by the National Professional Standards Review Council in consultation with the task force on guidelines of care of the American Medical Association Advisory Committee on PSRO.[1] This definition is as follows:

"Criteria: Medical care criteria are predetermined elements against which aspects of medical service may be compared. They are developed by professional expertise and based on the professional literature."

Donnebedean noted the confusion of the terms criteria and standard and stated that criteria are not only attributes of either process and outcome but often include "standards" within the definition.[2] It is this expanded concept that was used in the development of criteria for the audit instrument and review process.

Explicit/ Implicit Criteria

The audit instrument is divided into five parts that were designed to be performed sequentially. The audit progresses from primarily explicit criteria to combined explicit and implicit criteria. As presented in the manual, the definitions of explicit and implicit criteria are as follows:

Explicit Criteria: These are criteria that were set, developed or predetermined by group consensus of recognized authorities in the field.

Implicit Criteria: These are criteria that rely on the subjective evaluation of the auditor. They have been internalized by the individual and may differ according to the individual's knowledge, training and experience.

Explicit criteria are the most reliable in the that they are objectively stated; however, they may limit the evaluation of a practice.[3] Implicit criteria can accommodate all practice considerations including "softer" elements such as lifestyle and social issues. The drawback of the implicit review may be a reduced inter-rater reliability.[4] It was felt that the combination of both implicit and mainly explicit criteria with well chosen reviewers would provide a thorough evaluation of the quality of the dental practice and set the stage for an outcomes management approach.

Reliability

The criteria are evaluated using a two-point scale: acceptable and not acceptable. It was demonstrated by Houpt and Kress[5] and Hinkleman and Long[6] that the inter-rater reliability when using a two point scale is enhanced over both a three-point or five-point scale. The quality assurance manual defines each criterion in terms of what is acceptable and not acceptable.

Construction of Criteria

Most of the criteria for Record Review and Clinical Assessment of the audit process were developed using the mathematics of logic and decision-making, including Boolean Algebra (Algebra of Propositions)[7]

There are a set of propositions that form the basis for Boolean Algebra Laws (or propositional laws). These propositions are known as negation, disjunction, and conjunction. The proposition conjunction was used to set up most of the criteria for Record Review and Clinical Assessment. Conjunction is denoted by the word "and" between two or more elements. The proposition using "and" states that for a proposition to be true or acceptable (which is the term used in the audit), all elements need to be true, or acceptable if the criterion is to be rated acceptable. If one or more elements are not acceptable, than the entire criterion is rated unacceptable. For example, the criterion for the surface of a restoration can be formulated as:

- Smooth and not pitted—acceptable criteria

Therefore, if the restoration is both smooth and not pitted, then the standards for acceptable are met. If, however, the surface is rough and not pitted, or smooth and pitted, or (obviously) rough and pitted, then the criterion is rated unacceptable.

Cutoff Points

Most disease states are measured by tests that offer a continuous scale of values. Examples are blood pressures and laboratory tests for blood cell counts, glucose levels, and electrolyte counts. "Cutoff Points" are applied to differentiate between a normal (healthy) and abnormal (unhealthy) reading.[8] This same concept of using cutoff points was used in constructing the first ten clinical assessment criteria in Part III with the exception of Criterion 6 (surface). Using the literature as a guide, attempts were made to quantify a cutoff point between what was determined to be an acceptable and unacceptable state. An unacceptable state is one that has the potential to be deleterious to the health of the individual, ie., iatrogenic. Three criteria lent themselves to quantification: (2) Contour of gingival margins (operative); (6) Marginal integrity (crown and bridge); and (7) Gingival contour (crown and bridge). For each of these three, an acceptable criterion would be indicated by a state less than the amount presented, eg. an acceptable crown would have a contour less than one millimeter. This is similar to saying that a person does not have hypertension if the diastolic blood pressure is less than 90. The other criteria for

operative and crown and bridge were constructed similarly but could not be quantified in this manner. For example, the first criterion, marginal integrity (operative), is unacceptable if the margin is open to the dentin. This still provides a rather clear guide for the determination of this criterion.

General Concepts

Because the evaluation of health is not as clear cut as one would like, the criteria include conditioning factors which aid the reviewer in making a more accurate determination of the acceptability of most criteria. A good example of this is seen in Criterion 1—marginal integrity (operative) of Part III. The conditioning factor is "old restoration that is caries-free." What this says is that if a tooth with a marginal defect has been functional and free from disease for many years, then it should be considered acceptable because it has not been deleterious to the health of the patient. The remainder of the criteria in Part III, covering endodontics and prosthodontics, were adapted from criteria established by the Dental Society of the State of New York.

Part IV—Assessment of Treatment, uses implicit and explicit criteria. The reviewer is given guidance as to how to analyze each area but the final judgment is based on the knowledge and experience of the reviewer. The major consideration for each criterion is the effect of care or lack of care upon the health status of the patient (as is the consideration for the criteria in Part III). It is through evaluation of the diagnosis and treatment that the entire case management can be put into perspective and many of the "soft" issues analyzed.

Part V uses totally explicit criteria. There are three places for the reviewer to summarize findings. These are found at the finish of Parts III, IV and V. This is so the reviewer can provide an overall implicit judgment of patient care. These summaries use a four-point scale in order to give the reviewer more discrimination in this evaluation. The summaries are used for two purposes: they provide an overall "score" for the dentist and information with which to statistically weight the criteria.

References

1. AMA Advisory Committee on PSRO, Task Force on Guidelines of Care: PSROS and Norms of Care. *JAMA* 1974; 229:166.
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7. Gill A., *Applied Algebra for the Computer Sciences*. Prentice-Hall, Inc. Englewood Cliffs, NJ 1976.
8. McNeil, B., Neeler, E., Adelstein, S. J.; Primer on Certain Elements of Medical Decision Making. *N. Eng. J. Med.* 1975:293:212.

Calibration of Reviewers

In order to ensure inter- and intra-examiner reliability, the reviewers/auditors will meet for at least two* full days before the actual audit process begins. At this time, the full process of the audit is to be reviewed. All criteria will be defined and explained. Slides/photographs will be used to further define many criteria. All oral health status indicators will also be defined and explained.

After this is accomplished, the reviewers will each evaluate five patients who have been preselected and called in because they represent a cross section of what is likely to be found in an actual office audit, and as well offer the reviewers a chance to utilize information they have just received for as many criteria as possible. Reviewers will conduct the audits and results should be statistically tabulated to assess both intra- and inter-examiner reliability.

The following types of patients are important to sample for reviewer training and calibration:

1. An edentulous adult with full dentures
2. A partially edentulous adult with removable partial dentures and periodontal disease
3. An adult with fixed prosthodontics and periodontal disease
4. A young adult with rampant caries
5. A child with caries and a space maintenance problem

**This may be modified to one day, depending on the outcome of the first day's calibration.*

Logistics of Office Visit

Reviewers/ Auditors

A. Meet at assigned office at the prearranged time. The office being evaluated is responsible for providing instruments and other consumable supplies

B. Introduction to office staff

C. Patient charts and audit forms arranged according to schedule by office manager

D. Sequence of Audit Process

1. All forms for the study are completed by the patient.
   a) Medical Clearance
   b) Patient Registration (if applicable)
   c) Terms of Participation (if applicable)
   d) Oral Disability/Patient Satisfaction Index

2. Patient is seated and the following completed:
   a) Oral Health Indices
   b) Dental Record Assessment
   c) Clinical Assessment
   d) Assessment of Treatment

3. Patient is dismissed and operatory cleaned.

4. Infection Control Assessment (only one per office reviewed.)

E. Instruments and audit results collected by on-site office manager with one copy given to a reviewer/auditor

Note: If a positive finding is identified on the Brief Medical History Form, check with the guidelines as to how to proceed.

Sequence of Audit

Table III

Sequence	Supplies Needed	Who Does It?
Medical Clearance Patient Registration* Patient Consent* Patient Satisfaction Index	Brief Medical History Form Patient Registration Form Terms of Participation Form and Oral Disability Impact Patient Satisfaction Index	Office Manager
Oral Health Status Indicators	Mirror Explorer Periodontal Probe Cotton Rolls Gauze Squares Pen Light Audit Form Eye Protection Gloves Mask	Office Manager and Reviewer/Auditor
Radiographic Assessment and Dental Record Review	View Box Dental Record Audit Form	Reviewer
Clinical Assessment	Floss Mirror Explorer Periodontal Probe Gauze Squares Cotton Rolls Audit Form Eye Protection Gloves Mask	Reviewer
Treatment Assessment	View Box Dental Record Audit Form	Reviewer
Infection Control Assessment	Observation of techniques used in practice. Question staff about practices. Audit Form	Reviewer

**if applicable for the setting involved*

Patient Selection

Patient selection is best carried out in a randomized manner. For example, the office manager may select every second patient from a list of completed patients until 20 are chosen. These 20 charts should then be screened to assure that they are representative of the types of patients needed in the sample. If they are not, additional charts should be randomly selected until this can be achieved.

Clearly, various contingencies may preclude utilizing a randomized sample. In order of priority, the following broad guidelines for patient selection should be attempted.

- Randomized sample of 20—selected by office manager
- Randomized sample of less than 20—selected by office manager
- Staff Dentist presents office manager with list of 20 completed patients
- Patients scheduled on the day of the audit are seen instead of calling in a random sampling of completed patients

Guidelines for Patient Selection

The following are guidelines for patient selection. We recognize that each office may present unique problems. In developing these guidelines we have tried to account for as many contingencies as possible. Please adhere to these guidelines in order to maintain statistical accuracy between and within each office.

1. Appoint *20 completed* patients for each general dentist provider within the practice. If 20 completed patients are not available, use patients presently under treatment, yet exhibiting significant numbers of services already completed to review. (In some practices, the usual no show rate is approximately 50%, hence the large number of patients initially called. This number may be decreased depending upon experience.)
2. If possible the 20 completed patients should be selected randomly by clerical personnel.
3. *Notices should be mailed to all patients being reviewed 10–14 days before the actual review.* Follow up phone calls are suggested several days prior to the audit to insure attendance. Attached is a copy of the letter that one office uses to notify patients of their review. You may use or modify it, as you see fit.
4. It is suggested that the following type of patients be included in your sample:
   - An edentulous adult with full dentures
   - A partially edentulous adult with removable partial dentures and periodontal disease
   - An adult with fixed prosthodontics and periodontal disease
   - A young adult with rampant caries
   - A child with caries and space maintenance problem

   You may fill in the rest of the slots with patients exhibiting significant amounts of work to be reviewed. Remember, it does little good (in most cases) to recall patients who have had *no* work performed at the office—other than a prophylaxis and fluoride treatment, even though they are completed patients.

Sample 1: Letter To Ask Your Dentists to Select Patients

TO: ALL DENTISTS
RE: DENTAL QUALITY ASSURANCE AUDIT

The _____ Dental Quality Assurance Audit will be held during the week of _____. We would like to have ten patients present for each of our dentists. Since some patients will not keep their audit appointment, it would be best to call 20 potential patients for each dentist.

Please list below the names and chart numbers (if possible) of your patients who have had all (or most) of their active dental treatment completed, and who you feel would be willing to come in for the audit. Do not include patients who require antibiotic prophylaxis.

If possible, the following types of patients should be included in your sample:

A. An edentulous adult with full dentures.
B. A partially edentulous adult with removable partial dentures and periodontal disease.
C. An adult with fixed prosthodontics and periodontal disease.
D. A young child with rampant caries.
E. A young child with caries and a space maintenance problem.

Sample 2: Letter Inviting Patient to Participate In Review

Dear _____,

We would like you to please come to the Dental Department of the _____ Health Center, Inc. at _____ on _____ for an evaluation of the dental treatment you have received, as part of our Quality Assurance Program. The examination will take no longer than fifteen minutes. If we are to continue to maintain the same high quality of care that we have had in the past, it is important that you keep this appointment. There will be *no charge* for this visit.

If for any reason you cannot keep your appointment, please phone us immediately by calling (000) 000-0000. Please bring this letter with you on the above date and present it at the desk.

Sincerely,

Dental Director

Spanish Version:

Estimado _____,

Favor de venir al Departamento Dental de Centro de Salud _____, a las _____ para darle una evaluacion de los tratamientos dentales que usted ha recibidio. La examinacion no tardara mas de 15 minutos. Para poder mantener la alta calidad de servicios que nosotros ofrecemos es muy importante que usted mantenga su cita. No habra ningun cobro por esta visita.

Si por alguna razon usted no puede cumplir su cita, favor de llamar al (000) 000-0000 imediamente. Por favor triaga esta carta con usted y presentela a la receptionista.

Muchas gracias.

Sinceramente,

Jefe de Servicios Dentales

Section II *Audit Forms*

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

DATE ☐☐ MONTH ☐☐ DAY ☐☐ YEAR

REVIEWER _____

REVIEWER NUMBER ☐☐☐

NAME OF PRACTICE/SITE _____

PATIENT NAME _____

PATIENT NUMBER ☐☐☐☐☐☐☐

AGE ☐☐

I: ORAL HEALTH STATUS INDICATORS

Instructions: This section applies to persons who are dentulous. If the person is completely edentulous, check the box NOT APPLICABLE below and go to next section.

☐ Not Applicable

If the person is dentulous, continue below.

A. Count the number of teeth and place in box.

Total number of teeth ☐☐

B. Oral Hygiene/Periodontal Indicators

Evaluate the sample teeth and surfaces indicated below for each of the three indicators *for persons 13 years and older.*
Evaluate the Oral Hygiene and Gingival Indicators *only for persons 12 years and under.*
If a tooth is missing, DO NOT evaluate another tooth. Leave the boxes for that tooth blank.

Scale	
Oral Hygiene Index	0 = no continuous plaque 1 = continuous plaque
Pocket Depth	Write depth measured to the nearest millimeter in appropriate box. If one or more surfaces > 5 mm, place (✓) in summary box.
Gingival Index	0 = no bleeding within 30 seconds 1 = bleeding within 30 seconds

Surface Code

D = distal
M = mesial
F = facial
L = lingual

Tooth	Oral Hygiene (1) DF	(2) F	(3) MF	(4) L	Pocket Depth (5) DF	(6) F	(7) MF	(8) ML	(9) L	(10) DL	Summary Check box if any surface is > 5 mm	Gingival (11) DF	(12) F	(13) MF	(14) L
3 (A)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8 (E)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13 (I)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19 (K)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24 (O)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
28 (T)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

C. Caries Index

Place a Check (✓) in the box below the tooth that has new or recurrent caries and/or fractured teeth not restored where there is dentinal involvement.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

A	B	C	D	E	F	G	H	I	J
T	S	R	Q	P	O	N	M	L	K

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

PATIENT NAME _____

II: RECORD REVIEW

Instructions: Review the chart for the following criteria. Check (✓) the appropriate answer for each of the criteria below.

A. Radiographic Assessment

Review all radiographs taken during the last 5 years. If there is no radiographic survey taken during this time, use the most recent set in evaluating the first criteria.

	ACCEPTABLE	NOT ACCEPTABLE
1. Sufficient QUANTITY of films in last full mouth survey.	(1) ☐	(2) ☐
2. Evidence of a date on all films taken within last 5 years	(1) ☐	(2) ☐

3. QUALITY-check problem areas

- ☐ Insufficent contrast
- ☐ Distortion (elongation, foreshortening)
- ☐ Cone cut
- ☐ Other _____ SPECIFY
- ☐ Overlapping images
- ☐ Apex and surrounding bone not shown
- ☐ Poor developing

OVERALL estimation of QUALITY of x-rays taken within last 5 years	(1) ☐	(2) ☐

B. Dental Record Assessment

Check all criteria if present or absent.
If present, check if acceptable or not acceptable using definitions in review manual.

	PRESENT	ABSENT	ACCEPTABLE	NOT ACCEPTABLE
4. Patient Identification/Registration Data	(1) ☐	(2) ☐	(1) ☐	(2) ☐
5. Medical History/Dental History	(1) ☐	(2) ☐	(1) ☐	(2) ☐
6. Extra Oral/Intra Oral Examination	(1) ☐	(2) ☐	(1) ☐	(2) ☐
7. Dental Charting	(1) ☐	(2) ☐	(1) ☐	(2) ☐
8. Treatment Plan	(1) ☐	(2) ☐	(1) ☐	(2) ☐
9. Progress Notes	(1) ☐	(2) ☐	(1) ☐	(2) ☐
10. Informed Consent	(1) ☐	(2) ☐	(1) ☐	(2) ☐

11. Periodontal Charting

If the patient exhibits a pocket of 5 millimeters or more on one tooth or more in the Health Status Section on preceding page, check presence or absence of periodontal charting. If present, check whether acceptable or not acceptable. Check NOT APPLICABLE, only if there are no pockets of 5mm or more.

NOT APPLICABLE	PRESENT	ABSENT	ACCEPTABLE	NOT ACCEPTABLE
(1) ☐	(2) ☐	(3) ☐	(1) ☐	(2) ☐

Comments:

_____

_____

_____

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

PATIENT NAME _____

III: CLINICAL ASSESSMENT

Instructions: Review each of the criteria. Check (✓) acceptable or not acceptable if the criteria conform to the definitions provided in the review manual. For the first three categories (Operative, Crown & Fixed Prosthodontics, Endodontics), rate the criteria not acceptable if at least one tooth is judged not acceptable. Specify teeth and appliance judged not acceptable. If criteria not acceptable, indicate as such. More than 5 teeth found not acceptable should be noted in comment section.

Operative	NOT APPLICABLE	ACCEPTABLE	NOT ACCEPTABLE	SPECIFY TEETH EVALUATED AND NOT ACCEPTABLE
1. Marginal Integrity	(1) ☐	(2) ☐	(3) ☐	
2. Contour of Gingival Margins	(1) ☐	(2) ☐	(3) ☐	
3. Contact Areas	(1) ☐	(2) ☐	(3) ☐	
4. Occlusion	(1) ☐	(2) ☐	(3) ☐	
5. Surface	(1) ☐	(2) ☐	(3) ☐	
Crown and Fixed Prosthodontics				
6. Marginal Integrity	(1) ☐	(2) ☐	(3) ☐	
7. Gingival Contour	(1) ☐	(2) ☐	(3) ☐	
8. Embrasures	(1) ☐	(2) ☐	(3) ☐	
9. Gingival Contour of Pontic	(1) ☐	(2) ☐	(3) ☐	
10. Occlusion	(1) ☐	(2) ☐	(3) ☐	
Endodontics				
11. Apical Fill (Obturation)	(1) ☐	(2) ☐	(3) ☐	

Removable Prosthodontics **Partial Dentures**				SPECIFY APPLIANCE(S) EVALUATED NOT ACCEPTABLE	
12. Stability	(1) ☐	(2) ☐	(3) ☐	PL	PU
13. Retention	(1) ☐	(2) ☐	(3) ☐	PL	PU
14. Occlusion	(1) ☐	(2) ☐	(3) ☐	PL	PU
15. Extension/Tissue Adaptation	(1) ☐	(2) ☐	(3) ☐	PL	PU
16. Design & Framework	(1) ☐	(2) ☐	(3) ☐	PL	PU
17. Esthetics	(1) ☐	(2) ☐	(3) ☐	PL	PU
Complete Dentures					
18. Stability	(1) ☐	(2) ☐	(3) ☐	FL	FU
19. Retention	(1) ☐	(2) ☐	(3) ☐	FL	FU
20. Occlusion	(1) ☐	(2) ☐	(3) ☐	FL	FU
21. Extension	(1) ☐	(2) ☐	(3) ☐	FL	FU
22. Vertical Dimension	(1) ☐	(2) ☐	(3) ☐	FL	FU
23. Tissue Adaptation	(1) ☐	(2) ☐	(3) ☐	FL	FU
24. Esthetics	(1) ☐	(2) ☐	(3) ☐	FL	FU

Summary

Indicate in general the overall quality of the clinical work. (1) ☐ Excellent (2) ☐ Good (3) ☐ Fair (4) ☐ Poor

Comments: _____

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

PATIENT NAME _____

IV: ASSESSMENT OF TREATMENT

Instructions: Review the patient and chart for the first four criteria. Use judgement for the overall assessment of each of these five criteria using the specific areas listed under each criteria as a guide.

1. Completeness of Diagnosis Check problems overlooked or not noted in treatment

☐ Caries ☐ Gingivitis ☐ Periodontitis
☐ Missing Teeth ☐ TMJ/Facial Pain ☐ Oro/Facial Pathology
☐ Periapical Pathology ☐ Malocclusion ☐ Problems of Space Maintenance in children

Assessment of Diagnosis: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

2. Integration of Non-dental Considerations Review chart and interview patient about non-dental problems. Check areas not appropriately considered in treatment.

☐ Medical ☐ Emotional ☐ Drug Related ☐ Lifestyle

Assessment of Non-dental Considerations: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

3a. Appropriateness of Treatment Check services considered inappropriate

☐ Restorative ☐ Periodontics ☐ Endodontics
☐ Removable Prosthodontics ☐ Fixed Prosthodontics ☐ Pulp Protection
☐ Oral Surgery ☐ Orthodontics/Space Maintenance ☐ Medication Prescribed
☐ Other _____ SPECIFY

Assessment of Appropriateness of Treatment: (1) ☐ Acceptable (2) ☐ Not Acceptable

3b. Appropriateness of Preventive Care Review preventive care in chart

Assessment of Appropriateness of Preventive Care including sealants: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

4. Logical Sequence of Treatment Review progess notes and treatment plan in chart. Check areas that are not judged to be in proper sequence.

☐ Pain Control ☐ Caries Control ☐ Pulpal Therapy
☐ Preventive Services ☐ Malocclusion ☐ Periodontal Disease Control
☐ Space Maintenance ☐ Surgical Treatment ☐ Restoration of Missing Teeth
☐ Other _____ SPECIFY

Assessment of Logical Sequence of Treatment: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

5. Patient's Perception of Treatment Question patient on satisfaction in each of the following areas. Check problem areas.

☐ Comfort ☐ Esthetics ☐ Function ☐ Satisfaction With Dentist

Assessment of Patient's Perception of Treatment: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

6. Summary of Treatment Indicate in general the overall quality of treatment

Excellent (1) ☐ Good (2) ☐ Fair (3) ☐ Poor (4) ☐

Comments: _____

7. Summary of Case Management Indicate the overall quality of the total management of patient care. Review the chart, clinical, and treatment components before making a final assessment.

Excellent (1) ☐ Good (2) ☐ Fair (3) ☐ Poor (4) ☐

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

PATIENT NAME _____

V: Infection Control Assessment

Check criteria if acceptable or not acceptable using definitions in the manual (See Appendix D)

A. Infection Control

	ACCEPTABLE	NOT ACCEPTABLE	COMMENT REFERENCE
1. Vaccination (Hepatitis)	(1) ☐	(2) ☐	_____
2. Medical History	(1) ☐	(2) ☐	_____
3. Barrier Techniques (Gloves, Masks, Gowns, Eyewear)	(1) ☐	(2) ☐	_____
4. Environmental surface protection	(1) ☐	(2) ☐	_____
5. Handwashing/Care of Hands	(1) ☐	(2) ☐	_____
6. Use and care of sharp instruments and needles	(1) ☐	(2) ☐	_____
7. Sterilization and Disinfection	(1) ☐	(2) ☐	_____
8. Use and care of ultrasonic scalers, handpieces & dental units	(1) ☐	(2) ☐	_____
9. Decontamination of laboratory supplies and materials	(1) ☐	(2) ☐	_____

B. Hazard Communication Program

10. Hazard Communiclation Program	(1) ☐	(2) ☐	_____

C. Infectious Waste Disposal

11. Infectious waste disposal policy	(1) ☐	(2) ☐	_____

D. Statement of Office Policy

12. Written statement of office policy	(1) ☐	(2) ☐	_____

Summary:

Indicate in general the overall quality of the Infection Control Program.

(1) ☐ Excellent (2) ☐ Good (3) ☐ Fair (4) ☐ Poor

Comments/Reference:

_____

_____

_____

Instructions For Utilizing Audit Forms and Definition of Criteria

Part I Oral Health Status Indicators

This is the first part of the review and the most explicit. Alterations in the periodontium, as well as the main cause of periodontal diseases—microbial plaque—may be assessed and quantitated through the use of indices. These indices may also be used for epidemiological studies. The three indices utilized in this assessment evaluate the presence or absence of a symptom or etiological factor at the time of assessment. These indices have been chosen because they have been demonstrated to be simple, objective, reproducible, and practical.[1] They are amenable for use by auxiliary personnel and may be subjected to statistical evaluation. These indices, when used over time, may assist the dentist, reviewer and patient in assessing the success or failure of a particular course of treatment and preventive program.

These indicators serve to establish the status of the patient's oral health at the time of the clinical review. From this information, a profile will emerge for the office and for the entire sample of patients reviewed. It will also provide you with baseline information that will help you in subsequent sections of this review, particularly in Part IV. This part is divided into three sections.

Section A

This section consists of a count of the teeth in the patient's mouth. Count all the teeth, including third molars, that are erupted or partially erupted. *DO NOT* include unerupted teeth. If the number is less than ten (10), place a zero in the box on the left. [0][8]

Section B

This section measures the oral hygiene and periodontal status. Do these indicators in the following sequence: (These indicators have been used by Axelsson and Lindhe* in their studies).[2]

■ Oral Hygiene

Place disclosing solution (if utilized) on the facial and lingual surfaces of the primary or permanent teeth listed on the form.

Do not substitute another tooth if the listed tooth is missing.

Evaluate the plaque on each of the four surfaces identified on the review form. If the plaque is absent or discontinuous, place a zero (0) in the box. The pellicle, derived from a salivary glycoprotein, may stain slightly at the gingival margin. This is not considered plaque. The pellicle appears shiny and smooth like a varnish and plaque has thickness and is duller in appearance. Enclosed are photographs that will assist you in determining whether plaque is continuous or discontinuous (See photographs numbered 2, 4, 5, 6, 7, 8, 9, 10)

■ Pocket Depth

Using the Williams periodontal probe, measure all six areas on each of the teeth listed for all patients. The blade should be aligned with the long axis of the tooth. (See photograph 1 and 3) Note that the Williams periodontal probe is calibrated in millimeters as follows: 1, 2, 3, 5, 7, 8, 9, 10. Write the pocket depth in the box under the appropriate surface. If the person is 12 years or under, leave the boxes blank. As in the previous indicator, do not substitute another tooth if the listed tooth is missing.**

*Axelsson, P. and Lindhe, J., Effect of Controlled Oral Hygiene Procedures on Caries & Periodontal Disease in Adults, *J. Clin. Periodontic 5:133, 1978.*

***See Appendix A if you wish to utilize an abbreviated form.*

As you probe, make a gentle sweep in the sulcus or pocket as this will also be used to indicate the next indicator, the gingival index. This is the reason for probing children.

Gingival Index

After you have probed the teeth in the maxillary arch, check to see if there is any bleeding from the sulcus or pocket of the four surfaces listed on the review form. Start with the first tooth probed in the arch. Place a zero (0) in the appropriate box if there is no bleeding thirty (30) seconds after probing, and place a one (1) in the box if there is any bleeding thirty (30) seconds after probing. Follow the same sequence for the mandibular arch.

Section C

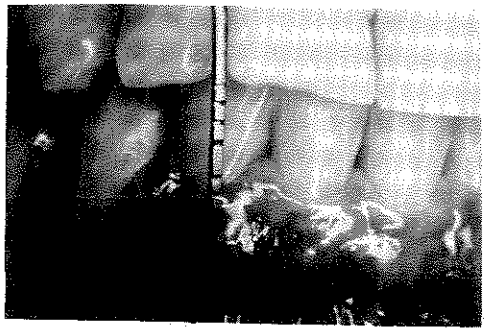
This section records the caries or fractured teeth that are unrestored at the time of the review.

Caries Index

First take a mirror and explorer and check for caries on the occlusal, facial and lingual surfaces. Place a check if you feel that the explorer sinks into the dentin. If you feel a catch but do not feel that the explorer goes to the dentin, do not check the box. Place a check if there is a fractured tooth with dentinal involvement.

Next, take a pen light and mirror and check for interproximal caries using transillumination. To do this, place the mirror inside the mouth and throw a beam of light on each interproximal area. If a shadow appears in the tooth, this is evidence of possible caries. To corroborate this, check the area with explorer. It is difficult to use this technique in molars.

Figure 1:
Use of the periodontal probe indicates that periodontitis is present with 4mm pocket.



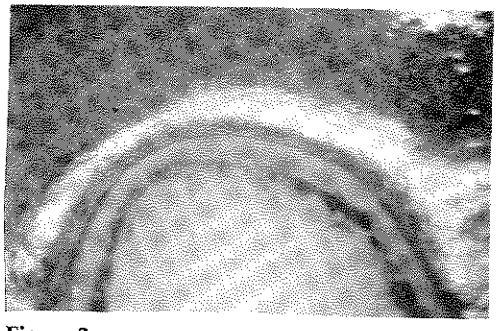
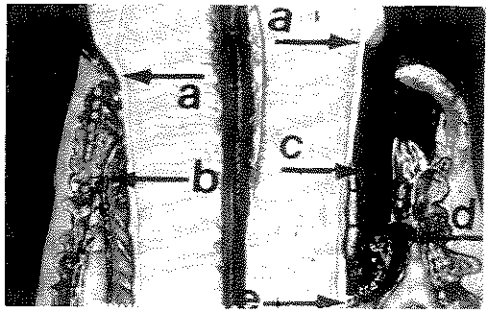


Figure 2:
Clinical entity of plaque. Continuous plaque D, F, M, even though very thin.

Figure 3:
Cross Sectional Diagram
a = level of CEJ and shallow sulcus in health
b = normal position of alveolar crest
c = destruction of bone and pocket formation
d = base of pocket
e = base of pocket



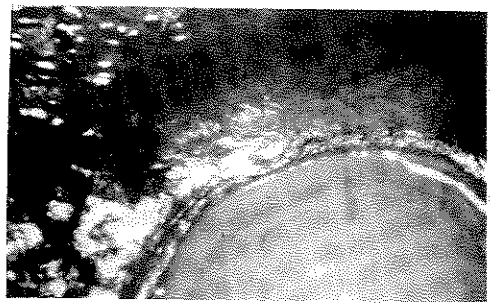


Figure 4:
Note pellicle. Rate as 0 for D, F, M. Pellicle is not plaque. DO NOT CONFUSE.

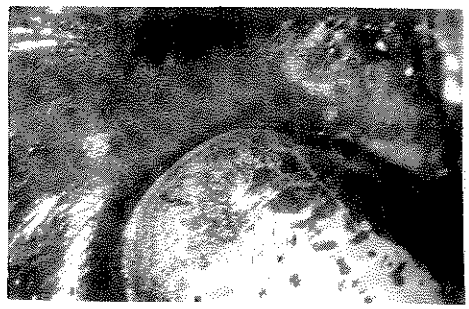


Figure 5:
Plaque representing thick furlike community—mature bacterial plaque in both supra and subgingival areas. Continuous for D, F, M.

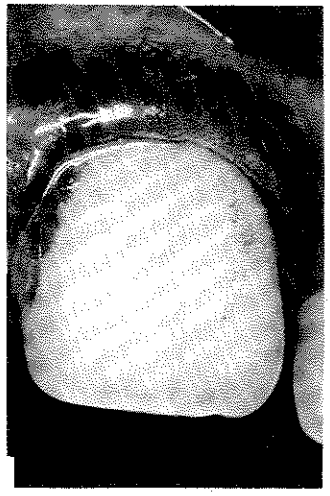


Figure 6:
Plaque—Continuous on Mesial, Rate 1. Discontinuous on Distal and Facial, Rate 0 for both.

Figure 8:
Moderately thick growth of plaque. Continuous—M, F, D, rate 1.

Figure 7:
Plaque—Assess if this is continuous. Continuous—Facial and Distal, rate 1. Discontinuous—Mesial, rate 0.

Figure 10:
Heavy plaque accumulation seen with flourescein dye. This patient has dilantin hyperplasia. Continuous for all surfaces, rate 1.

Figure 9:
Is this continuous or discontinuous? Note the plaque in cervical areas. Mesial—discontinuous, rate 0. Note slight interruption of plaque. Facial and Distal—Continuous, rate 1.

Part II: Record Review and Radiographic Assessment

This is the second part of the review. This area will determine if the chart and radiographs meet the criteria as stated in this section. We are looking to see if the basic documentation needed for patient and risk management exists for each patient.

A. Radiographic Assessment

Instructions: Take out all radiographs taken within the last five (5) years, if applicable. Reviewers must categorize the patient as new or recall.

Criteria for Prescribing Dental Radiographs must be individually tailored to the patients needs depending on age; relative risk of dental or other disease; new or recall visit.[3-5]

1. Sufficient quantity of films to comply with Guidelines recommended by ADA and HHS. (See Table IV)[4]

1. Sufficient Quantity of Radiographs

Category	Acceptable	Not-Acceptable
CHILD Primary Dentition Transitional Dentition ADOLESCENT ADULT Dentulous Edentulous	Adherence to criteria in Table IV, Guidelines for Prescribing Dental Radiographs.	Too few or too many films according to Table IV, Guidelines for Prescribing Dental Radiographs.

NOTE: *The reviewer must select acceptable or not acceptable in* ONE *age category, (above) and fill in the appropriate box on the audit form after evaluating the patient for relative risk of disease and new or recall status.*

Table IV:

The Selection of Patients for X-Ray Examinations:

Dental Radiographic Examinations

When, and for Which Patients, Should You Perform a Dental Radiographic Examination?

Articles in the dental literature have questioned the scheduling of dental radiographs on a routine basis because such scheduling does not take into account the differing signs and symptoms of patients. The question arises whether the results of routine radiographic examinations contribute to patient management; if not, such routine scheduling results in unnecessary patient exposure.

To assess the proper use of radiographs in dental care, a panel of dental experts was convened under the sponsorship of the Food and Drug Administration's Center for Devices and Radiological Health, to review the literature and other clinical evidence on the utility of dental radiographic examinations. The panel, representing general dentistry, periodontics, pediatric dentistry, oral medicine, and dental radiology, developed the prescription strategy presented here. The strategy contains guidelines that will assist the dentist in deciding when a radiograph is appropriate. The panel emphasizes that the guidelines are voluntary; they are intended to aid the judgment of the dental practitioner, not to supersede it.

This pamphlet presents only the conclusions of the panel's work. A full report, describing development of the prescription strategy and citing studies used by the panel, can be ordered from the Government Printing Office using the attached form. This report also addresses concerns about the use of dental radiographs during pregnancy or to identify occult disease.

How To Use This Prescription Strategy

The panel strongly endorses the concept that a history should be taken and a clinical examination of the patient should be completed *prior to* deciding whether dental radiographs should be made.

Once it has been determined that radiographs are needed, three decisions must be made.

- Determine whether the patient presenting for dental care is making a new or a recall visit.
- Categorize the patient by chronological age and by developmental stage or dental status, i.e., child (primary or transitional dentition); adolescent; or adult (dentulous or edentulous).
- Assign the patient to a risk category based on history and clinical signs and symptoms. The risk categories are: clinical caries or high risk factors for caries; no clinical caries and no high risk factors for caries; and periodontal disease or a history of periodontal treatment. A category for assessment of growth and development is also included.

After making these decisions, read the appropriate guideline from the chart. Because the patient's condition may change over time, it is necessary to periodically reconsider the type of visit, age category, and/or risk group.

Remember: This prescription strategy neither precludes nor requires dental radiography when your clinical judgment suggests otherwise.

This strategy was reviewed and approved by the following organizations: Academy of General Dentistry; American Academy of Dental Radiology; American Academy of Oral Medicine; American Academy of Pediatric Dentistry; American Academy of Periodontology; American Dental Association.

Table IV: Guidelines for Prescribing Dental Radiographs

The recommendations in this chart are subject to clinical judgment and may not apply to every patient. *They are to be used by dentists only after reviewing the patient's health history and completing a clinical examination. The recommendations do not need to be altered because of pregnancy.*

Patient Category	Child		Adolescent	Adult	
	Primary Dentition *(prior to eruption of first permanent tooth)*	Transitional Dentition *(following eruption of first permanent tooth)*	Permanent Dentition *(prior to eruption of third molars)*	Dentulous	Edentulous
NEW PATIENT*					
All New Patients to Assess Dental Diseases and Growth and Development	Posterior bitewing examination if proximal surfaces of primary teeth cannot be visualized or probed	Individualized radiographic examination consisting of periapical/occlusal views & posterior bitewings *or* panoramic examination & posterior bitewings	Individualized radiographic examination consisting of posterior bitewings & selected periapicals. A full mouth intraoral radiographic examination is appropriate when the patient presents with clinical evidence of generalized dental disease or a history of extensive dental treatment.		Full mouth intraoral radiographic examination *or* panoramic examination
RECALL PATIENT*					
Clinical caries or high-risk factors for caries**	Posterior bitewing examination at 6-month intervals *or* until no carious lesions are evident		Posterior bitewing examination at 6–12 month intervals *or* until no carious lesions are evident	Posterior bitewing examination at 12–18 month intervals	Not applicable
No clinical caries and no high-risk factors for caries**	Posterior bitewing examination at 12–24 month intervals if proximal surfaces of primary teeth cannot be visualized or probed	Posterior bitewing examination at 12–24 month intervals	Posterior bitewing examination at 18–36 month intervals	Posterior bitewing examination at 24–36 month intervals	Not applicable
Periodontal disease or a history of periodontal treatment	Individualized radiographic examination consisting of selected periapical and/or bitewing radiographs for areas where periodontal disease (other than nonspecific gingivitis) can be demonstrated clinically		Individualized radiographic examination consisting of selected periapical and/or bitewing radiographs for areas where periodontal disease (other than nonspecific gingivitis) can be demonstrated clinically		Not applicable
Growth and development assessment	Usually not indicated	Individualized radiographic examination consisting of a periapical/occlusal *or* panoramic examination	Periapical *or* panoramic examination to assess developing third molars	Usually not indicated	Usually not indicated

***Clinical situations for which radiographs may be indicated include:**

A. Positive Historical Findings
1. Previous periodontal or endodontic therapy
2. History of pain or trauma
3. Familial history of dental anomalies
4. Postoperative evaluation of healing
5. Presence of implants

B. Positive Clinical Signs/ Symptoms
1. Clinical evidence of periodontal disease
2. Large or deep restorations
3. Deep carious lesions
4. Malposed or clinically impacted teeth
5. Swelling
6. Evidence of facial trauma
7. Mobility of teeth
8. Fistula or sinus tract infection
9. Clinically suspected sinus pathology
10. Growth abnormalities
11. Oral involvement in known or suspected systemic disease
12. Positive neurologic findings in the head and neck
13. Evidence of foreign objects
14. Pain and/or dysfunction of the temporomandibular joint
15. Facial asymmetry
16. Abutment teeth for fixed or removable partial prosthesis
17. Unexplained bleeding
18. Unexplained sensitivity of teeth
19. Unusual eruption, spacing or migration of teeth
20. Unusual tooth morphology, calcification or color
21. Missing teeth with unknown reason

****Patients at high risk for caries may demonstrate any of the following:**
1. High level of caries experience
2. History of recurrent caries
3. Existing restoration of poor quality
4. Poor oral hygiene
5. Inadequate fluoride exposure
6. Prolonged nursing (bottle or breast)
7. Diet with high sucrose frequency
8. Poor family dental health
9. Developmental enamel defects
10. Developmental disability
11. Xerostomia
12. Genetic abnormality of teeth
13. Many multisurface restorations
14. Chemo/radiation therapy

2. Quality of Radiographs

Instructions: Review the radiographs for each of the considerations listed on the audit form. Check problem areas. To estimate overall quality, evaluate the severity of the problems and use the criteria below to make your final judgment.

Acceptable

If all dental diseases can be diagnosed with these radiographs even with some of the above listed problems, then quality is acceptable.

Not-Acceptable

If dental diseases cannot be diagnosed with radiographs, they are not acceptable.

3. Evidence of date on all films taken within last 5 years

Acceptable

All film mounts or packets are dated.

Not-Acceptable

If at least one or more mounts or packets is not dated.

B. Dental Record Assessment

Instructions: Review the dental record for each of the following criteria.[6,7] Check each area *Present* or *Absent* and *Acceptable* or *Not Acceptable* according to the definition of each criteria.

4. Patient Identification/ Registration Data

Acceptable

This is acceptable if necessary personal information, name, address, phone, insurance data is present.

Not-Acceptable

Unacceptable if one element of patient registration (name, address, insurance, telephone) data is missing.

5. Medical History/ Dental History

Acceptable

A medical history is acceptable if all of the following problems are included:
(a) Drug allergy, rheumatic and other heart diseases, radiation or chemotherapy, hepatitis, diabetes, drug history, bleeding problems or history of intra cardiac or joint prostheses and other infectious diseases, ie; AIDS. There must be evidence of medications and dosage as well as any other systemic or familial factors that may compromise dental treatment;
(b) evidence of updating medical history is found at each recall examination;
(c) evidence of chief complaint, reason for dental visit and past dental history is found.

Not-Acceptable

The medical history is unacceptable if at least one of the problems is not included and, if the update was not done at each recall exam.

	Acceptable	Not-Acceptable
6. Extraoral/ Intraoral Examination	Findings of normal, pathologic or abnormal conditions should be noted. Look for a statement that the area examined is within normal limits. Positive findings should be noted and explained.	Findings are not recorded and explained.
7. Dental Charting	There should be evidence of a legible notation status of caries and missing teeth. This notation should include the existing status of the dentition at the initial clinical examination. There should be notation of needed services as well.	There is an illegible notation of caries and missing teeth. There is no charting of the existing status of the dentition, nor is there a charting of the needed services.
8. Treatment Plan	The treatment plan is legible and easily located within the dental record. The plan is logical, sequential and may list options and referrals to specialists when appropriate.	The treatment plan is neither legible nor easily located within the dental record. The plan is not logical, sequential and does not list options or referral needs.
9. Progress Notes	There is legible and dated notation of treatment rendered at each visit in ink, including anesthesia, pulpal protection or medications prescribed. Entries must be signed by the person entering the data. Record entries should not be altered. When a correction is necessary, a single line should be drawn through the entry. Any changes should be signed and dated.	The notation of treatment is not legible, not in ink and not dated at each visit. There is no documentation of anesthesia used or medications prescribed. There is no signature present. Corrections are improperly done and changes are not signed and dated.

10. Informed Consent

Acceptable

There should be evidence of written consent before performing complex procedures or other procedures where there is material risk for the patient. (Three elements are needed to assure valid informed consent: (1) the patient is advised of all essential information in a manner that is comprehensible, relating to the prescribed treatment plan; (2) the patient has the opportunity to ask questions; (3) the patient provides a clear indication as to proceed or not with the suggested treatment.) When the consent is not in writing, the dentist should note in detail in the progress notes the discussion concerning risks that has occurred.

Not-Acceptable

There is no evidence of written informed consent or notation in the progress notes of the discussion that occurred with the patient concerning risks.

11. Periodontal Charting

Instructions: If there are no pockets of 5 mm., check NOT APPLICABLE. If the patient exhibits a pocket of 5 mm. or more on one tooth or more in the Oral Health Status Section, check if *Present* or *Absent* and *Acceptable* or *Not-Acceptable* according to the definition of each criteria.

Acceptable

There is evidence of notation of pocket depth and tooth mobility.

Not-Acceptable

There is no evidence of pocket depth and tooth mobility.

Part III: Clinical Assessment of Technical Proficiency

In this part the technical aspects of Restorative, Prosthodontic and Endodontic care are measured against the definitions of the criteria that follow.

Review each criterion one at a time looking at every tooth where the criterion applies. Do not look at a tooth or single prosthetic appliance for multiple criteria. It is essential that each criterion be evaluated independently throughout the entire mouth.

Instructions: REVIEW EACH OF THE CRITERION
Each criterion **must** be checked for ONE of the following:
(1) NOT APPLICABLE
(2) ACCEPTABLE
(3) NOT ACCEPTABLE

If the criterion is not applicable, check NOT APPLICABLE (1) on the audit form. Check ACCEPTABLE (2), if the criterion conform to the definition of acceptable. For the first three categories, Operative, Crown & Fixed Prosthodontics and Endodontics, rate the criterion NOT ACCEPTABLE if at least one tooth is judged not acceptable. Specify teeth and appliance judged not acceptable. More than five (5) teeth found NOT ACCEPTABLE should be noted in COMMENTS section, at the bottom of the form. A series of photographs is included to assist you in internalizing these criteria. The photographs are keyed to each criterion.

A. Operative

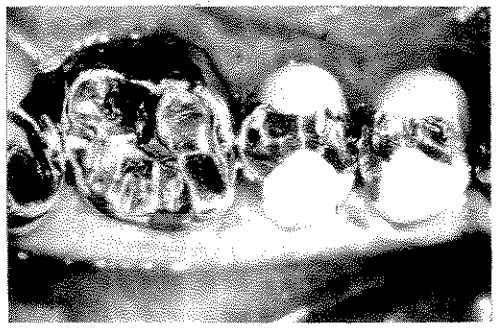
1. Marginal Integrity

Acceptable

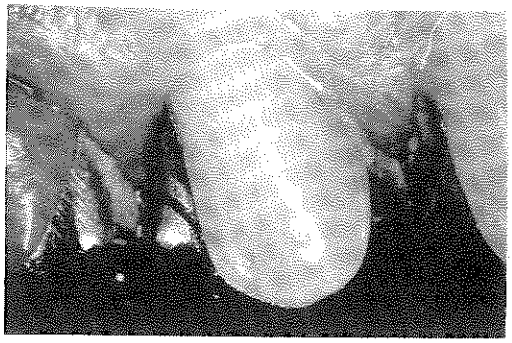
The margins of amalgams and synthetics are smooth to the explorer or demonstrate either a slight but easily removable excess or a slight but correctable ditching into the enamel. Certain old restorations may appear to be inadequate but one should evaluate the serviceability of the restorations if the tooth has remained caries free. Old restorations with ditching that may not be easily correctable but are caries free should be considered adequate.

Not-Acceptable

A severe deficiency into the dentin that is either observable visually and/or probable by explorer is rated not acceptable. A fractured restoration is obviously inadequate. There are visible or recurrent caries. Check with the patient for symptoms.



Criterion #1
Note the excellent gingival and other margins. Even excellent restorations (as seen by these margins) do not insure against plaque accumulation; they only make its removal easier.



Criterion #1
Note the excellent gingival and other margins. Even excellent restorations (as seen by these margins) do not insure against plaque accumulation; they only make its removal easier.

2. Contour of Gingival Margins

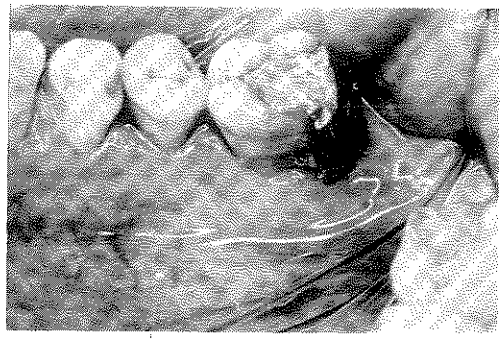
Acceptable

The gingival margin of amalgams and synthetics are smooth to the explorer. The important consideration in gingival margins is the patient's ability to remove plaque. The gingival health should be no different than adjacent teeth with no restorations.

Not-Acceptable

An excessive overhang of at least one millimeter is one that blocks the embrasure and/or extends well beyond the gingival margin of the restoration into the pocket making plaque removal difficult or impossible. The gingiva in these instances may be more inflamed than adjacent teeth. The key to evaluating this is the health of the tooth and gingiva. The restoration is obviously inadequate if there is caries or gingivitis as a result of plaque retention. If the reviewer is unsure, check the restoration with dental floss. If the floss shreds and/or is unable to cleanse the pocket, then the restoration is inadequate. Also, ask the patient if there is difficulty in cleansing this tooth.

Criterion #2
Overhanging and bulky restoration. This may result in both caries and gingival inflammation at margins.



Criterion #2
This radiograph demonstrates proximal contours of fillings which do not reproduce natural tooth contours and may obliterate normal embrasure spaces. Poor margins, contours, contacts.

	Acceptable	Not-Acceptable
3. Contact Areas	A contact is closed if light is completely blocked and or if floss meets definite resistance when drawn through the contact area. *See photos for criterion 1*	The contact is obviously open or if the floss meets no resistance. Ask the patient if he/she is troubled by food impaction. If yes, the contact is inadequate. The outcome of this criteria may be based more on patient comfort than on a disease process.

	Acceptable	Not-Acceptable
4. Occlusion	The restoration (gold or amalgam) presents no or minimal facets. The patient experiences no occlusal discomfort. The radiograph is within normal *anatomical* limits in terms of the periodontal membrane. *See photos for criterion 1*	The restoration presents excessive facets and the tooth demonstrates signs of occlusal trauma. These are: a. mobility or tooth migration not accounted for by bone loss from periodontal disease. b. widening of the periodontal membrane on radiograph. c. clinical soreness of the tooth upon percussion. A tooth may have facets but it may not be in premature occlusion because the restoration has adapted to the occlusion. To test this adaptation, the reviewer should check for fremitus* or active mobility. If the tooth exhibits fremitus and the adjacent teeth do not, then the restoration should be considered inadequate. ***Fremitus—a sensation felt by a finger placed on the gingival and alveolar mucosa that vibrates during occlusion.*

	Acceptable	Not-Acceptable
5. Surface	Surface is smooth and not pitted. *See photos for criterion 1*	Surface is rough and pitted.

B. Crown and Fixed Prosthodontics

6. Marginal Integrity

Acceptable

The margins of crowns are smooth to the explorer. The explorer should be able to pass up the margin with minimal resistance.

Not-Acceptable

A margin with an obvious catch is considered inadequate. Defects in margins are associated with plaque retention and therefore, related to periodontal disease and recurrent caries. The key to evaluating this is the health of the periodontium and tooth. However, as overcontoured crowns (next criteria) will also cause gingivitis it would be difficult to separate causal factors. Because the slightest defects in margins (.2 mm) are correlated with gingivitis, any questionable defect should be rated not acceptable.

7. Gingival Contour

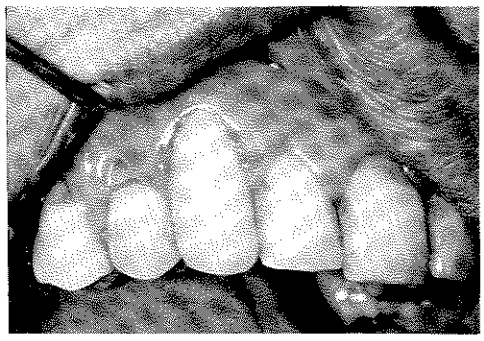
Acceptable

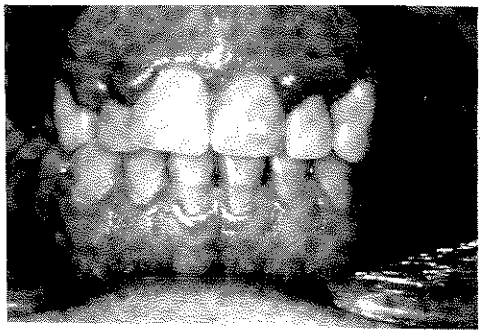
Crown contours should approximate closely those of the natural tooth. Proximal contours are usually flat or slightly concave. Buccal contours demonstrate a slight convexity at the cervical third and lingual contours are generally flat at the cervical third.

Not-Acceptable

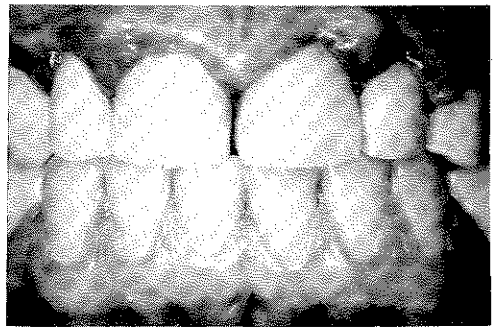
Almost all but the slightest (less than 1 mm) convexity should be considered inadequate. Excessive contours favor plaque retention and promote gingivitis. If there is uncertainty in rating a restoration, evaluate the gingiva for inflammation and check the gingival sulcus. If either one is substantially different from adjacent teeth that are not restored with crowns, restoration should be rated not acceptable.

Criteria #6 and #7 Porcelain crowns illustrating gingival inflammation due to poor marginal fit and contour.



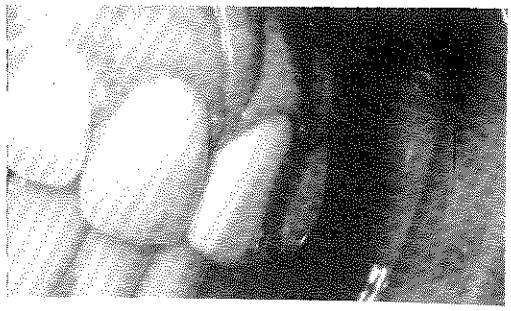


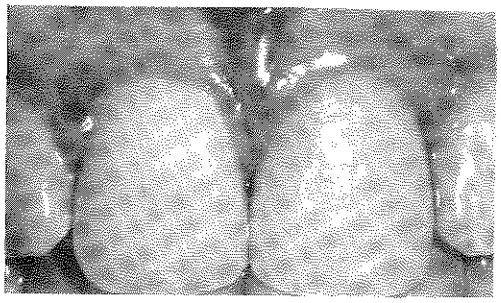
Criterion #7 Defective ceramic crowns causing gingival inflammation. Inadequate contours with plaque retention.



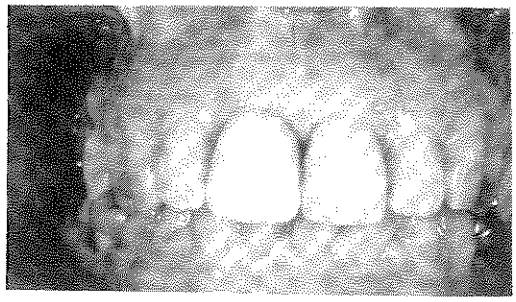
Criterion #7 Defective ceramic crowns causing gingival inflammation. Inadequate contours with plaque retention.

Criterion #7 (a)
In this profile view of a provisional crown, note the emergence profile of the restored crown and level of the gingival margin.

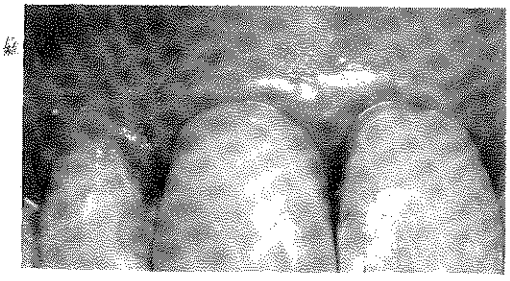




Criterion #7 (b)
This is the completed restoration (Porcelain fused to metal). Note the levels of the gingival margin on the labial surface as compared with the level of the adjacent tooth.

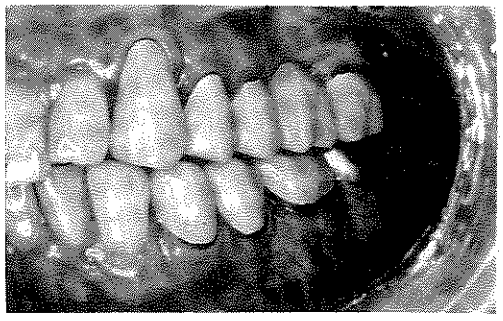


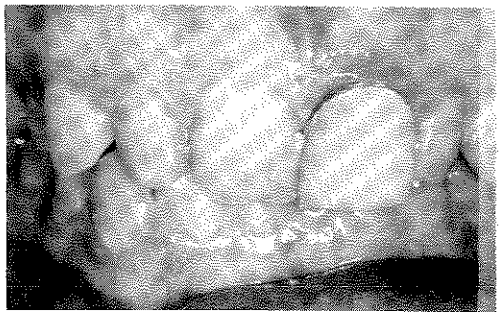
Criterion #7 (a)
Recession has exposed the subgingival portion of the convexity so the entire anatomic crown of the maxillary right incisor can be seen. The restoration was placed 5 years. ago. Note the unfavorable gingival reaction and aesthetically unacceptable restoration. The reason for the unfavorable reaction is the convexity placed subgingivally. The portion of the crown placed subgingivally should mimic the flat form of the root, not the convex form of the anatomic crown.



Criterion #7 (b)
This is the completed restoration on the same tooth. Note that the portion of the restoration that enters the sulcus has the flat form of the root, not the convex shape of the anatomic crown.

Criteria #6, 7 and 8
Note that the gingival margin is at correct level over the mesial root of the 1st molar. This is an example of restoring the proper supra and subgingival contours with crowns.



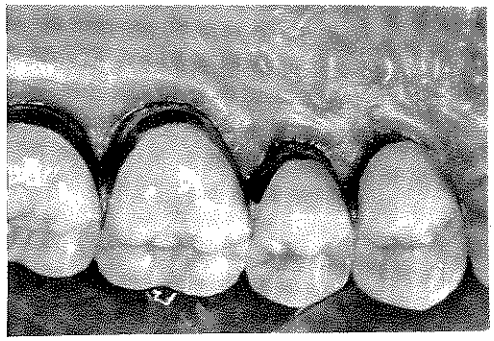


Criterion #7
Note inflammation about the acrylic crown. This is an example of supragingival overcontouring.

8. Embrasures

Acceptable

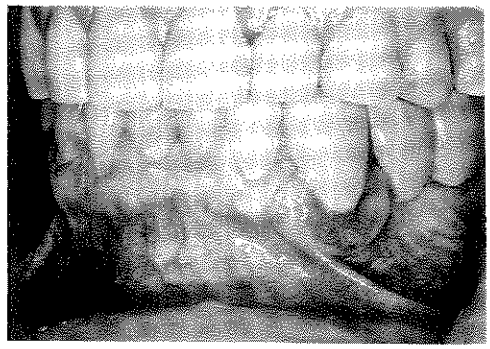
The embrasure space should approximate the anatomical dimension of natural teeth and should neither be too narrow, which encroaches on the papilla, or too wide, which encourages food impaction.



Criterion #8
This demonstrates acceptable embrasures.

Not-Acceptable

Any embrasure is rated inadequate where the papilla is thick, rolled, overgrown and inflamed or where the patient complains about food impaction. Poor plaque control impacts uniformly on all gingival tissues. If there is uncertainty, evaluate the inflammation in the embrasure area with gingival inflammation in adjacent non-restored teeth in the same quadrant or the opposite arch on the same side. If the inflammation is substantially different in the embrasure area, it should be rated inadequate.



Criterion #8
Gingival inflammation due to poor restoration. Note the cleft and poor embrasures.

9. Gingival Contour of Pontic

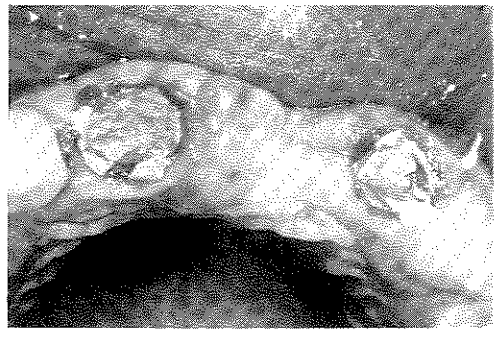
Acceptable

A pontic should have a flat or convex gingival surface that is readily accessible for plaque removal by flossing. The pontic should either gently or minimally contact the residual ridge. The pontic should be easy to clean.

Not-Acceptable

Pontics that lap the ridge facially and lingually and/or exert pressure on the edentulous ridge causing ulceration are unacceptable. If there is doubt as to the contour of the pontic, run floss under the pontic. If there is not even pressure on the floss, then the pontic is concave and is inadequately designed. Observe the pontic area for food impaction. Ask the patient if maintenance of hygiene and food impaction around the pontic area is a chronic problem.

Criterion #9
A poor maxillary anterior bridge. When removed you can see a common error—excess cement. Also note the ill fitting pontic and impingement on the tissue.



10. Occlusion

Acceptable

The restoration presents no or minimal facets or attrition. The patient experiences no occlusal discomfort. The radiograph is within normal anatomical limits.

Not-Acceptable

The restoration presents excessive attrition or facets and the tooth demonstrates signs of occlusal trauma. These include:

a. mobility or tooth migration not accounted for by bone loss from periodontal disease.

b. widening of the periodontal membrane on the radiograph.

c. clinical soreness of the tooth upon percussion.

A tooth may have facets but it may not be in premature occlusion because the restoration has adapted to the occlusion. To test this adaptation, the reviewer should check for fremitus or active mobility. If the tooth exhibits fremitus and the adjacent teeth do not, then the restoration should be considered not acceptable.

C. Endodontics

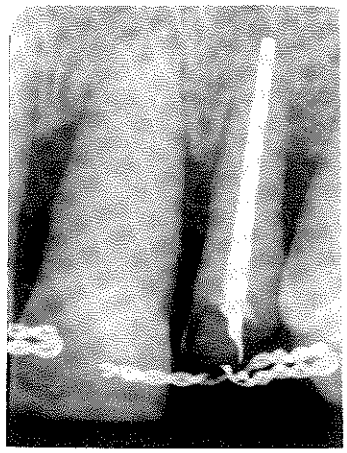
11. Apical Fill (Obturation)

Acceptable

If the radiograph is available the image of filling material appears to occupy the root canal space totally, both laterally and vertically. Inadvertent underfills and overfills are satisfactory if no post operative sequelae of long duration have occurred. There are no voids in the apical ⅓ of the tooth which may precipitate periapical pathology. It is desirable that obturation be within 1 mm. of the anatomic apex.

Not-Acceptable

If the radiographic image of the filling material appears not to totally occupy the root canal space, particularly in the apical ⅓ and chronic periapical inflammation continues or has occurred, it is not acceptable. There is persistence or enlargement of a periapical or lateral area of pathology. Fills that do not completely obturate the root canals or have not been proven biologically acceptable. If unsure, check the patient for symptoms.



Criterion #11
Acceptable endodontic obturation.

D. Removable Prosthodontics Partial Dentures

Instructions: Make an assessment for all criteria as they apply to each partial or full denture the patient is wearing.

■

12. Stability

Acceptable

Stability is defined as the resistance of the denture to horizontal and rotational forces. This is acceptable when moderate biting and chewing pressure exerted on the denture unilaterally does not displace it. Such pressure does not visibly displace or blanch supporting tissues. There is no impingement on the tissue. If stress breakers are used, slight movement of the denture base is a function of design.

Not-Acceptable

The denture rocks or is unseated by horizontal or rotational forces. There is obvious and excessive blanching of tissues and impingement of the denture on tissues.

■

13. Retention

Acceptable

The denture provides sufficient attachments, clasps, occlusal rests and base extension to satisfy requirements for optimal retention. Retention is defined as the resistance to vertical force necessary to unseat the denture to retain it in normal function and to remove it voluntarily. The denture slips in and out with gentle pressure or a light snap. Occlusal rests are seated. There is evidence of indirect retention for tooth and soft tissue supported dentures. Tooth and soft tissue supported dentures derive retention from direct clasp attachment as well as from maximum extension and adaption of the denture base.

Not-Acceptable

Heavy seating pressure is required to snap or force the denture into position. There is insufficient retention so that the denture is loose and can be displaced without resistance. There is undue stress and impingement on the teeth.

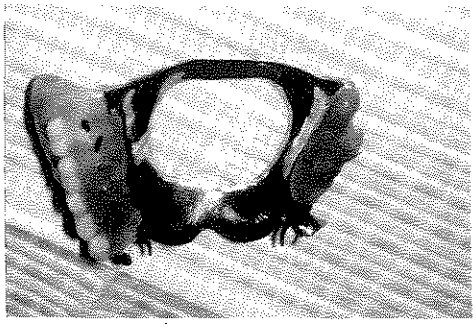
14. Occlusion

Acceptable

The occlusal scheme of the removable partial denture fits in with the scheme presented by the natural remaining teeth. It is desirable, when there are no opposing natural tooth contacts, to utilize habitual centric relation as the reference point for establishing a functional occlusal scheme. If there are opposing natural teeth and the scheme presented by these contacts is acceptable, the removable partial denture is considered in a functionally acceptable occlusion. There should be no interference in lateral excursions and interocclusal contacts should be evenly distributed. Look for bilateral simultaneous occlusal contact.

Not-Acceptable

Look for premature contacts causing skidding or sliding on closure or lack of contact of the artificial teeth. In lateral excursions, there are interfering cusps on the removable partial denture. Note uneven wear patterns on artificial teeth. Any occlusal discrepancies that may be considered to contribute to a functionally and physiologically unstable occlusion are not acceptable.



Criterion #14
A fractured partial upper constructed at an excessive vertical dimension of occlusion which prevented the natural teeth from contacting. Fortunately in an effort to restore the vertical dimension, the patient destroyed the prosthesis rather then the supporting tissue.

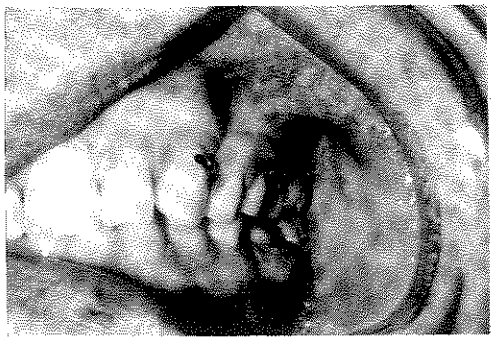
15. Extension/Tissue Adaptation

Acceptable

Assess whether the denture base areas are sufficiently extended to incorporate a peripheral seal with the mucobuccal and mucolingual folds. Look for close adaptation of the denture base to the tissues to minimize food and debris collection and promote hygienic qualities of the removable partial denture. All supporting tissues appear healthy without signs of inflammation, irritation, ulceration or hyperplasia.

Not-Acceptable

Look for a denture base that is obviously over or under extended. Space may be clearly visible between the perphery of the base and tissue. Supporting tissue appears inflamed, irritated, ulcerated and hyperplastic in spite of adequate oral hygiene by the patient.



Criterion #15
Although the denture base for this RPD is not extended to the mucobuccal fold, it is sufficient and adequate to replace the lost osseous structure and to prevent food impaction.

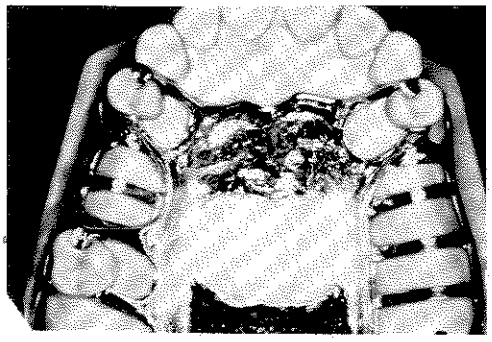
16. Design and Framework

Acceptable

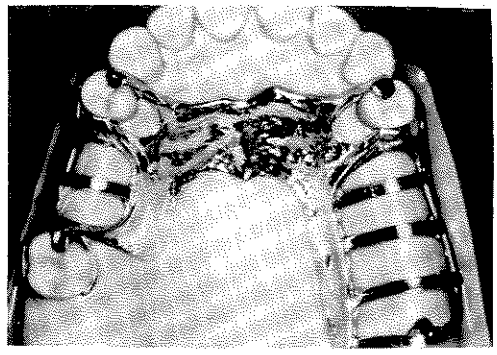
A stable framework includes such factors as rests completely seated, clasps that are passive on the teeth, adequate clasps to resist lateral movement, and use of indirect retainers. Look for a lingual or palatal bar (if present) where the metal closely approximates the tissue but without impingement. There are degrees as to how well a partial fits. Ask patients if they are satisfied. If yes, look for caries under poorly seated rests or tooth mobility on clasps that are not passive. If there are no problems and the patient is satisfied, the removable partial denture should be considered adequate. Observe for evidence of satisfactory rest preparation.

Not-Acceptable

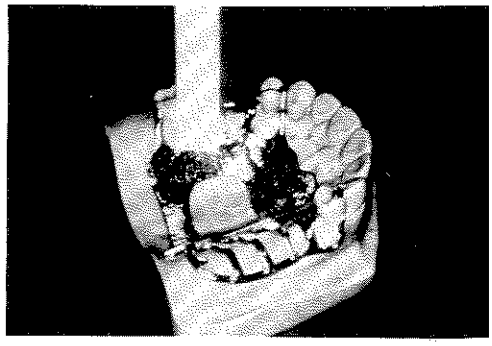
A partial frame that does not seat and is causing tissue irritation to the patient is considered inadequate. There is lack of satisfactory rest preparation. A history should be taken too, because the patient may have dropped or otherwise distorted the partial or had a debilitating illness causing ridge resorption. If so, this should be noted.



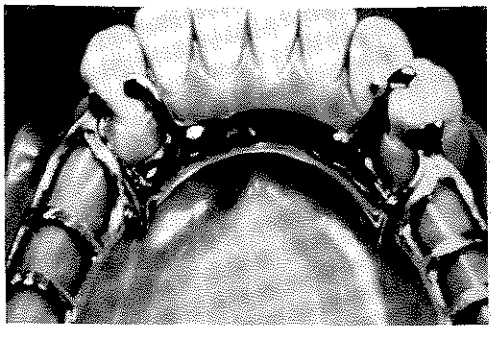
Criterion #16
Anterior and post bar combination is an excellent maxillary major connector design choice for various arches. (Class II and IV)



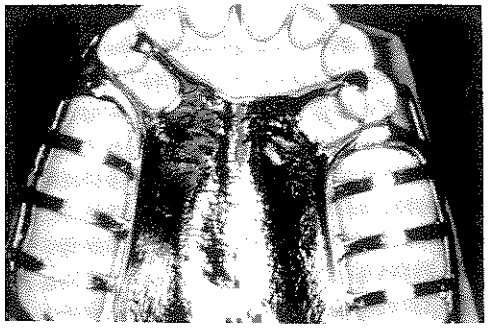
Criterion #16
This U-shaped maxillary major connector does not take advantage of the available support system as fully as a prosthesis that allows for broader coverage of the palatal tissues. It is indicated if an inoperable torus is present.



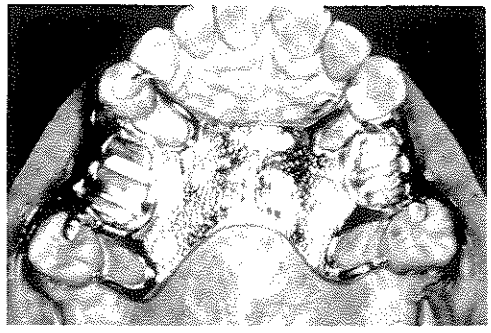
Criterion #16
Borders of all maxillary major connectors should be placed well away from the gingiva in order to maintain gingival health.



Criterion #16
This shows a conventional lingual bar major connector with 2 design features: a. Relief from underlying tissues (no impingement). b. pear shaped cross sectional form mesial rests on free end saddle.

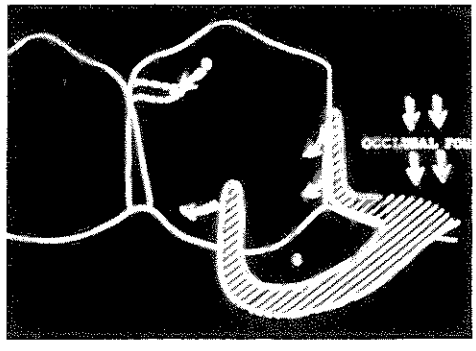


Criterion #16
This palatal plate connector is also used for Class I & III arches. The greater area of contact distributes forces more equitably to abuttment teeth and the residual ridge.



Criterion #16
This is also acceptable as design for framework.

Criterion #16
When occlusal forces are applied to the distal extension base, the distal proximal plate should disengage from the distoproximal tooth surface. This allows the clasp assembly to rotate about the mesial rest in the rest seat.



Criterion #16
The mesial minor connector of an RPI (Rest proximal plate I bar) clasp assembly on the distal extension abutment tooth is *not in contact* with the adjacent lateral incisors. *Contact* would have *prevented* the clasp assembly from fulfilling its stress breaking capability when the distal extension base is subjected to occlusal forces.

■

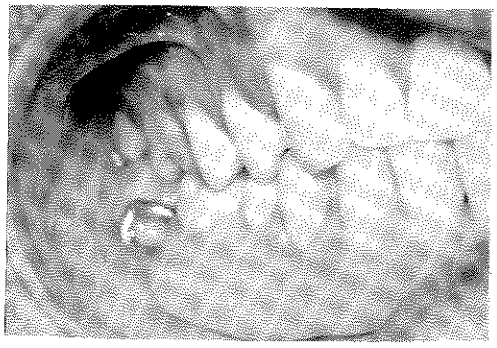
17. Esthetics

Acceptable

The patient is satisfied with the look of the removable partial denture. There is proper facial and lip support. The artificial teeth are a reasonable match with the natural teeth in both shape and shade. Clasps are as inconspicuous as possible.

Not-Acceptable

The patient is not satisfied with the look of the removable partial denture. There is inadequate or excessive facial support. The clasps are conspicuous when alternative clasping arrangements were possible. The artificial teeth are a poor match in shape and shade with the natural teeth, particularly in the anterior region.



Criteria #15, #17
Artificial teeth of RPD were selected carefully to harmonize with shape, size, buccolingual position, degree of cuspation and gingival occlusal height of the natural dentition.

E. Complete Dentures

■

18. Stability

Acceptable

The denture remains seated when masticatory pressure is applied and when the patient speaks or smiles. The denture may still be satisfactory if there is slight movement on biting or chewing pressure but the patient is not aware or adverse to it and if this slight movement does not cause tissue discomfort.

Not-Acceptable

The denture becomes loose during normal functional exercises such as talking, smiling or mastication and the deficiency cannot be corrected.

■

19. Retention

Acceptable

Retention is satisfactory if the denture remains seated during normal muscular functional activity.

Not-Acceptable

The denture exhibits no resistance to being dislodged.

20. Occlusion

Acceptable

Observe if the interocclusal contacts are evenly distributed. There should be bilateral simultaneous contact of all posterior teeth. Look to see if the teeth do not come in contact when the patient talks; listen for clicking reflecting the presence of sufficient interocclusal space. It is desirable that centric occlusion be coincidental with centric jaw relation at the correct vertical dimension and physiological tolerance of the patient. Other occlusal relationships may also be acceptable if they are physiologically and functionally tolerated by the patient.

Not-Acceptable

Centric occlusion is not in harmony with centric jaw relation causing discomfort and inability to wear the dentures for the patient. Occlusal discrepancies may also cause tilting, slipping, or sliding of the denture bases. There may be evidence of premature contact on closure into occlusion as well as occlusal interference in lateral or protrusive excursions. Also look to see if the denture is dislodged by lateral or protrusive excursions. Observe the patient for poor phonetics and difficulty in speaking.

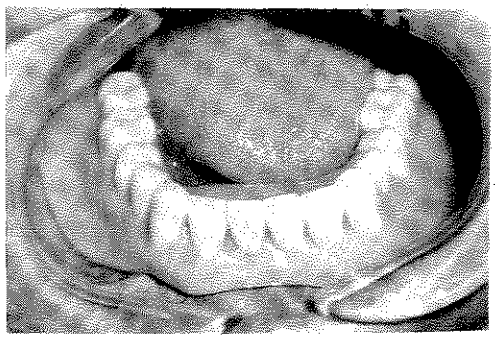
21. Extension

Acceptable

There is a proper peripheral seal at the mucobuccal, mucolabial and mucolingual folds and the denture base covers those areas of the arches that provide maximum support. The maxillary denture covers the entire hard palate. The post dam area extends from the hamular notch to form a posterior palatal seal on the soft palate without evidence of inflammation or ulceration. There is proper relief of frenal attachments compatible with function. The mandibular denture has full lingual flanges, normally extending to or slightly beyond the mylohyoid ridge and extending distally to cover a portion or all of the retromolar pad. The buccal shelf is covered laterally to the external oblique ridge. The denture base adapts closely to the tissues without evidence of inflammation, ulceration or hyperplasia.

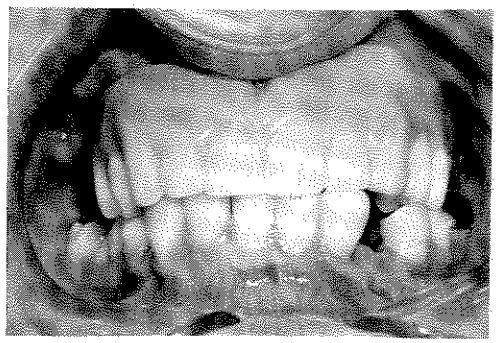
Not Acceptable

Look for over or under extended bases, evidence of tissue irritation, inflammation hyperplasia, ulceration from the denture flanges. The peripheral seal may be unacceptable.



Criterion #21
F/L denture. Note the full extension onto the buccal shelf areas which distribute occlusal forces to these primary denture supporting tissues.

Criteria #21, #24
The labial flange of the prosthesis is fully extended to provide lip and cheek support necessary to enhance aesthetics.



Criterion #21
Epulis Fissuratum. Example of the effects of an overextended lower denture.

22. Vertical Dimension

Acceptable

Acceptable vertical dimension should provide adequate facial and muscular support, phonetics, masticatory function and scaffolding of the muscles of mastication. Check the rest position to see if freeway space is acceptable.

Not Acceptable

Assess the facial musculature to evaluate if there is adequate support from the denture. In particular, vertical dimension is not acceptable if angular cheilosis (not associated with systemic disease) exists or is a recurring problem to the patient. This may suggest loss of vertical dimension. Note ridge resorption, attrition and wear of denture teeth that also contribute to decreased vertical dimension. It is not acceptable if there is difficulty in speech or mastication.

23. Tissue Adaption

Acceptable

The dentures should be biologically compatible and acceptable to the oral tissues and structures. There should be no evidence of inflammation, irritation, hyperplasia or ulcerated tissue.

Not Acceptable

There is evidence of inflammation, irritation, hyperplasia, redundant or ulcerated tissue causing discomfort to the patient. Look for rough spots on the denture bases, over extended flanges or impingement on frenum attachments.

24. Esthetics

Acceptable

There is proper facial and lip support. The shape and shade of the denture teeth appear natural. The dentures are conducive to clear speech. Ask the patient if he is satisfied with the look of the dentures.

Not Acceptable

The patient is not satisfied with the look of the dentures. There is inadequate or excessive facial support. The shape and shade of teeth do not appear natural.

Summary

Now pull back and review the entire area of clinical proficiency and indicate your assessment—excellent, good, fair or poor. Comments should be written in the space provided.

Part IV: Assessment of Treatment

It is in this area that the reviewer has an opportunity to use his/her own judgment in reviewing the dental treatment provided. Each criteria requires several considerations in order to make an assessment of acceptability of the treatment rendered. Therefore, a list of these pertinent considerations is provided as a *guide* for making a decision. Any consideration listed that is not appropriately dealt with by the dentist should be checked in the box adjacent to that consideration. The judgment of the acceptability of each criteria is based largely on the reviewer's evaluation. However, it is important to consider the health status of the patient. *If the patient demonstrates a generally healthy oral health status despite minor differences or lapses in diagnosis, improper sequence of care, or slightly inappropriate care, then the treatment should be considered acceptable.* At all times keep in mind whether case management in all its aspects has been appropriate and has met the needs of the patient.

In making your decisions, always ask yourself if the incompleteness of diagnosis, and/or lack of integration of the non dental considerations and/or inappropriateness and/or improper sequence of treatment, have had an ADVERSE EFFECT on the oral health status of the patient.

The following guidelines should be helpful in considering each of the criteria:

1. Completeness of Diagnosis

- First, perform a brief clinical examination of the patient. Evaluate the soft tissues, the temporomandibular joint, the muscles of mastication, and the occlusion. Review the caries and periodontal status noted in the first part of the clinical audit form.
- Second, review the chart for both clinical findings and the treatment provided in the past. Check any consideration listed that was not appropriately diagnosed, either through notation in the chart and/or through actual treatment.
- Third, to assess the acceptability of diagnosis, evaluate the severity of each problem not appropriately diagnosed. Consider whether or not the incompleteness of diagnosis had an adverse effect on the oral health status of the patient; then make a judgment on the acceptability of the completeness of the diagnosis.

2. Integration of Non-Dental Considerations

Review the chart and question the patient about non-dental problems. Each of the following four considerations should be reviewed, particularly in complicated cases:

Medical: Review medical problems that either alter the course of dental disease and/or impact on the process of dental treatment. Examples of the former include diabetes, blood dyscrasias, Sjogrens syndrome, and hormonal imbalances. Examples of the latter include rheumatic heart disease, ischemic heart disease, intracardiac prosthesis, asthma, hepatitis, and hematological disease, and other infectious diseases such as AIDS.

Emotional: Review psychological problems. Stress, anxiety, and depression can decrease salivary flow. Stress may be a confounding factor in gingivitis and possibly periodontitis and certain types of stomatitis, as well as an etiological factor in myofascial pain dysfunction. Anxiety and depression can detrimentally affect routine compliance with necessary home preventive care and compliance with routine maintenance dental care.

Drug Related: Review all medications currently being taken by the patient. Medications that can affect the course of treatment include Dilantin, tranquilizers, anticoagulants, steroids, high doses of aspirin, and anti-cholinergic medications. Also note drug allergies, chemotherapeutic agents, immuno-suppressive drugs, drugs that cause severe side-effects, and medications that interfere with the proper development of the dentition such as tetracyclines. A history of intravenous drug abuse may have significant consequences.

Lifestyle: Lifestyle has been shown to have a major impact on general health status. In assessing its implications in dentistry, review dietary and nutritional considerations, the intake of excessive alcohol and other drugs, intravenous drug abuse, smoking, the patient's occupation, and other areas that make up one's lifestyle. These are sensitive issues. Therefore, pursue this area carefully with patients unless there are obvious problems in treatment such as rampant caries in middle-aged persons, evidence of severe post-operative problems after surgery, or a history of frequent replacements of prostheses. These are clues to be considered in making your final assessment.

In order to determine the effect of non dental considerations, ask yourself again, if this has had an adverse effect on the oral health status of the patient.

3. Appropriateness of Treatment

The appropriateness of care can be defined as the impact of treatment in meeting the needs of the patient. Inappropriate treatment may be either too little (underutilization) or too much treatment (overutilization).

Section a: reviews the appropriateness of treatment. Review pretreatment radiographs (if possible), the progress notes, and the present status of dental services in order to make a judgment. Check the services considered inappropriate; if that service is needed but not provided or that service is inappropriate for the problem (too much or too little). Examples include extensive restorations for a moderate caries problem, excessive or no periodontal treatment, unwarranted extractions of teeth, inadequate space maintenance in children, and overprescribing of antibiotics. Review all the services provided and make an assessment on the appropriateness of the treatment provided.

Section b: reviews the appropriateness of preventive care. It is important to remember that caries and periodontal disease are infectious diseases caused by specific bacteria and are responsive to factors that alter the plaque and host resistance. Preventive services work both to prevent disease (primary prevention) and to control the disease once started (secondary prevention). Traditional dental services, particularly restorative services, do not deal with the disease process but tend to restore what was lost to the disease process. Preventive services *DO* interfere with the disease process and should be an integral part of dental care.

In evaluating the appropriateness of preventive services, follow the course of the disease from the progress notes in the chart.

If caries is rampant or a continual problem there must be evidence of diet counseling and intervention with multiple fluoride therapies. These should be appropriately selected for each patient based on age, caries status and concentration of fluoride in the local water supply.[8-11]

Of particular importance is the appropriate use of occlusal sealants.[12] The reviewer must evaluate whether sealants have been used when indicated. Sealant use is clinically indicated for permanent molars, premolars at risk for fissure caries and some primary molars (depending on morphology and caries activity). Sealants

should be placed as soon as possible after tooth eruption for it is at this time that teeth are most susceptible to caries activity. The combination of occlusal sealants (fluoride is least effective in preventing occlusal caries) and fluoride therapies (fluoride is most effective against smooth surface lesions) is a critical preventive area for the reviewer to evaluate. Reviewers **must** adhere to the criteria for sealant use in Appendix B.

If periodontal disease is present and progressive, note if maintenance visits are more frequent. What is the frequency of maintenance visits? Are they greater than three months if significant periodontal problems are present. If so, the reviewer must make a decision on the appropriateness of periodontal care in terms of frequency of recall, disease status and patient compliance.

The reviewer must also assess whether effective antimicrobial mouthrinses and or antibiotic therapy has been initiated in a timely manner to ameliorate the progress of periodontal disease. If this data is not in the record, utilize the patient as a source of information on the acceptability of the preventive care prescribed.

Significant additional guidance for the reviewer comes from incorporating the recommendations of the U.S. Preventive Services Task Force (in the areas of dental caries, periodontal disease, malocclusion, trauma and oral cancer) into whether the appropriateness of preventive care is acceptable.[13-15] (See Appendix C)

If the dentist has made use of all reasonable preventive modalities then check this area as acceptable.

4. Logical Sequence of Treatment

The order in which treatment is completed is an important factor in managing dental disease. In general:

- The **first step** should be the elimination of disease that is progressing rapidly and/or is threatening the health of the individual and/or is causing pain
- The **next step** is the elimination of non-urgent disease
- The **final step** is the rehabilitation of the mouth to normal function and esthetics and establishment of an ongoing maintenance program with periodic and appropriate recall

The sequence should be in logical order. Examples of this are completion of a root canal treatment before fabricating a crown; extracting all teeth requiring removal before constructing a partial, recognizing periodontal disease and treating the periodontium before placing permanent or complex restorations.

- **Review the treatment** in terms of each consideration through the progress notes and treatment plan in the chart
- Then **review the condition** of the patient's mouth
- Finally, **make your decision,** asking yourself if deviation from a logical sequence of treatment has adversely affected the oral health status of the patient

5. Patient's Perception of Treatment

This is the last criterion related to treatment. It is a summary of the patient's perception of treatment and oral health status. To avoid biasing the patient's answers, obtain the information for each of four considerations by asking the following straight forward questions:

a. "Does your mouth feel comfortable now?"

b. "Do you like the way your mouth looks?"

c. "Are you satisfied with the way you chew your foods?"

d. "Are you satisfied with the care provided by your dentist?"

If there are problems, check the appropriate box and list the reasons in the COMMENTS section. To assess the acceptability of the patient's perception of treatment, evaluate the severity of the patient's problems with the care provided.

A more comprehensive Oral Disability Impact/Patient Satisfaction Index (ODI/PSI) will be given to each patient at the time of the Audit. This will further assess the patients quality of life and functional status as they relate to dental problems.

Now, pull back and review the entire area of treatment and indicate your assessment in the section marked SUMMARY OF TREATMENT.

Now pull further back and review the entire management of care; the oral health status, the record review, the clinical assessments and the assessment of treatment. Quickly review your assessments in each section. Then make a final assessment of all aspects of how the case was managed in the section marked SUMMARY OF CASE MANAGEMENT

Part V: Infection Control Assessment

This section will be done only *once* for each office/practice reviewed. The criteria are explicit and based on recommendations from the Centers for Disease Control (CDC), the American Dental Association and regulations developed by the Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA). These recommendations and regulations are explicit and outcome based for they serve to prevent the spread of communicable diseases, thereby reducing morbidity and mortality associated with them.[16-21]

In assessing this area, the reviewer needs to have internalized the CDC, OSHA and EPA criteria found in Appendix D. The reviewer must also take time to walk through the facility in order to observe infection control practices. The reviewer should interview staff, professional and auxiliary, during the day, and along with observation obtain enough information to assess whether infection control practices are acceptable. When sufficient information is gathered the reviewer must check each area as either *Acceptable* or *Not Acceptable*. If *Not Acceptable* is checked, a comment must be made suggesting how compliance may be achieved and referencing the area(s) in the CDC, OSHA, EPA criteria that are deficient. The reviewer must also be assured that a written Infection Control policy statement exists for the office being reviewed.

A summary indicator is provided for the reviewer to assess the overall quality of infection control activities. The reviewer must check either Excellent, Good, Fair, or Poor and include comments if necessary.

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Patient Medical History Questionnaire and Reviewer Guidelines

Brief Medical History

Instructions: Please review the answers to questions asked before proceeding with the assessment.

	Yes	No
1. Have you ever had Rheumatic Heart Disease?	☐	☐
2. Have you ever had any type of joint prostheses placed?	☐	☐
3. Have you ever had any type of valvular heart prostheses inserted?	☐	☐

If there is a yes answer to any of the above questions, please observe the following guidelines.

- If there is a YES answer seek further information from the patient and dental record as to the severity of the problem. If the patient has been treated previously by the attending dentist without prophylactic antibiotic coverage and the patient's physician has not recommended it, then you may proceed with the audit.
- If, however, the patient answers YES, and needs prophylactic antibiotic coverage *do not undertake any dental manipulations*. You may however continue the assessment but do NOT undertake any pocket depth probings or gingival indices. Write medical contraindication across Form A, IB—on pocket depth & gingival indices. You may proceed with the oral hygiene index.
- If there is a YES answer, and the patient and/or dental record provide you with insufficient information on which to make a decision, or the slightest doubt exists as to whether to proceed, do not undertake any dental manipulations.

Responsibilities of the Reviewer

This section delineates the responsibilities of reviewers to both the patient and dentist being evaluated. The interaction of the reviewer with both patient and dentist in the office setting is crucial to the success of the audit process. As many contingencies as possible will be addressed so that the quality review process remains consistent and reliable from one practice setting to another. Most importantly, the procedures that follow speak forcefully for the protection of the patient while still protecting the dentist-patient relationship during the quality assurance process.

Responsibilities and Role of the External Evaluator

- General considerations include the maintenance of cordial relations between office staff (dentist and auxiliaries, if they are present) and patients. The reviewers must attempt to conduct themselves in as NON-JUDGMENTAL a manner as possible with dentists and patients. Assuming a NEUTRAL position whenever possible is important in conducting the audit as effectively and efficiently as possible. This may be further aided by avoiding contact and/or discussion of individual cases with the participating dentists and patients.

- The evaluator is also serving as an intermediary to the director of the office or facility. In institutional settings, the evaluator may be a member of the Quality of Care or Quality Assurance Committee or other named committees with like responsibilities.

The evaluator's role is *simply* to provide the evaluation results on the audit form, **both positive and negative**, which will go to the attending dentist, and director of the facility, who may act upon these findings. Each attending dentist will receive a copy of each audit at the end of the audit session which serves to provide immediate feedback. When the reviewer recognizes additional dental needs (as noted on the audit form), the attending dentist has the responsibility to **inform the patient** and remedy the situation within a reasonable time. These patients will be tracked manually by the office director. Patients requiring additional care may be recalled for another audit in the future to assure that remedial action has been taken.

If additional dental needs are present which demand **immediate** attention, such as a suspected neoplasm, the reviewer is required to bring this to the immediate attention of the attending dentist. The attending dentist is required to immediately act upon or make arrangements to ameliorate the situation. Reviewers **must indicate that immediate attention is needed** in the comment section of the audit form. These situations will in turn be handled by the office or facility director.

The following situations may also occur and it is suggested that they be managed by the reviewer in the following manner:

Situation 1: The patient who expects judgment on dentists work and wants a verdict, good or bad?
Suggested Response: Maintain as neutral and nonjudgmental a stance as possible. If no additional work is needed, let the patient know that their dentist will discuss the results with them. If additional work is needed, follow the procedure as outlined previously. You may also say that the audit is divided into multiple parts and several will not be completed during the time the patient is here, so a final verdict is not possible at present.

Situation 2: The patient who complains about the dental work in his mouth and takes this opportunity to lash out at the dentist.
Suggested Response: Try and maintain as neutral and nonjudgmental a stance as possible. Explain to the patient that there are several areas in the audit that address this issue:

- the patient satisfaction index that they answer anonymously.
- the evaluator's questions to the patient addressing their satisfaction in Part IV of the audit procedure. You may also indicate that one of the purposes of the audit process is educational with practitioners deriving benefit from the information obtained.

Situation 3: The patient who exhibits dental needs which have not been treated and is unaware of this problem.
Suggested Response: The reviewer may, if asked, indicate to the patient that his own dentist may wish to see him in the near future for a more thorough examination. The attending dentist then has the responsibility of informing the patient within a reasonable time and rectifying the situation. In this way, the obligation that the patient be informed of clinical findings is met and the dentist-patient relationship is honored.

Situation 4: Patient who presents oral problems needing immediate attention such as a suspected neoplasm.
Suggested Response: It is the responsibility of the reviewer to bring this to the attention of the attending dentist immediately, through copies of each audit form. The attending dentist will be required to immediately act upon or make arrangements to ameliorate the situation. If the attending dentist is not available, the director will bring this to the attention of the dentist the following day. All patients of this nature will be followed up to insure accountability to the patients involved.

Situation 5: Patient who asks, "Why is my doctor being audited"?
Suggested Response: Explain the nature of the quality assurance process trying to utilize the frame of reference of the consumer. Indicate goals and objectives of the audit process, the importance of accountability, the voluntary aspect of each participating dentist. You may also mention that it has the support and is recommended by a broad spectrum of groups within organized dentistry. It indicates concern by the doctor being audited of maintaining the highest standards of quality. The emphasis is to protect the patient, educate the dentist and patient and provide ongoing feedback to the dentist on the quality of his work.

Situation 6: The dentist who becomes irate, angry and decides this audit won't work.
Suggested Handling: Ask the dentist to sit down with the Director to discuss any problems that are occurring. If he refuses and wishes to discuss it with you, emphasize the objectives and importance of his participation in a quality assurance program. Stress the educational aspects for both dentists and patients. Indicate that he is in the vanguard of the entire quality assurance movement. Suggest that the marketability of his practice will be increased by participation.

Situation 7: The dentist who wants to discuss the review results with you.
Suggested Response: Assume a neutral stance. Only discuss generalities if pressed. You may wish to indicate some positive qualities observed if that will defuse a potentially caustic situation. Indicate that once results are tabulated all audits will be shared with the attending dentists. Stress the educational aspect of the audit to both patient and attending dentist. Indicate that the Director must review all audit results before they are finalized. In this way, any information he obtains will come from his peers.

In summary, the focus of the quality assurance system upon which you are about to embark should be educational. However, it is important to recognize the need to take necessary corrective actions to protect each patient.

The Role of the Quality of Care/ Quality Assurance Committee

The evaluator serves as an intermediary to the Quality of Care or Quality Assurance Committee. Quality Assurance Committees are often standing committees within institutional, private or corporate practices charged with overseeing Quality of Care issues. It is likely that a Quality Assurance system such as the one described here will become integrated within a Quality of Care Committee. The evaluator's role is to provide the evaluation results, both positive and negative, to the attending dentist and the Quality of Care Committee, which may act upon these findings.

The Quality of Care Committee will receive and review the findings of all the clinical evaluations. If additional dental work is required, the Committee will recommend a plan of action to the attending dentist under question and recommend a time frame for action. One member of the committee may be responsible for follow-up of problems identified.

Follow-up will be facilitated through the use of feedback forms which will identify any problems found, a plan of action and a time frame for action. In addition, a response form will be provided to the dentist to be completed when the recommended plan of action has been initiated.

If, after the specified time frame (based on a period of time which is reasonable yet not injurious to the patient) the attending dentist has not initiated the plan of action, the Committee will have the responsibility of contacting the patient to inform him that during his examination he was found to require additional dental work; and then devising a corrective action plan for the dentist.

The Quality of Care Committee will also review, in conjunction with the facility director, management information system and indicator data generated by each provider. Appropriate feedback will be transmitted to providers with this data. Appropriate feedback may also be transmitted to facilities with a Board of Directors by the Quality of Care Committee, as a means of assuring accountability at the Governing Board or corporate level.

Interpretation of Audit Results

Once the review process has been completed, there still remain two very important activities that must be performed. The first is **interpretation of results**, and the second is dissemination of these **results** to the treating provider(s).

Examination of Findings

Results should be examined on both the **Individual Provider Level** and an **Aggregate Level**. Review of each audit form, representing each patient's findings, is best performed by the responsible treating practitioner, to examine which areas on that patient were judged acceptable or not-acceptable. The practitioner is most familiar with what was originally intended by a specific treatment plan, and the result of actual treatment provided. Comments or notes provided in the margins of the form will be there for the provider to better understand how his/her work was interpreted. This can best be accomplished by giving the provider a copy of all four pages of each patient's audit form. Lastly, this gives the practitioner written documentation of specific treatments that may need remediation.

Aggregate results are useful for observation of **trends** that may be present, for example; lack of periodontal awareness, use of substandard x-rays for diagnosis, poor record keeping, etc. These results can be tabulated and compiled on a **provider level** and/or a **practice/center level**.

Tabulation of Aggregate Results

All calculations in these audits involve determination of simple percentages (except for the pocket depth calculations in Part I of the audit) derived from ratios of "acceptable" to "not-acceptable" findings. These can be accomplished on a pocket calculator, then added together, but for any significant volume of audits, it makes sense to utilize a computer. A complete program has been developed for this quality assurance system and is available, for purchase, to interested parties. The program is a significant complement to maximizing the positive aspects of this system. For information about this, please contact the Clinical Directors Network, 81 Chester Place, Suite J-2, Englewood, N.J. 07631, 201/569-3123.

Because some of the responses, especially those utilizing Boolean Algebra, are best calculated using formulae to arrive at a percentage, a list of such formulae is presented:

Audit Form I. Oral Health Status Indicators

A. Number of Teeth
(used as denominator in I-C)

B. Oral Hygiene Indicators

Oral Hygiene: $\frac{\text{Number of '0's}}{\text{Number of '0's plus Number of '1's}}$

Pocket Depth: $\frac{\text{Sum of all surface pocket depths}}{\text{Total number of surfaces}}$

Gingival: $\frac{\text{Number of '1's}}{\text{Number of '0's plus number of '1's}}$

C. Caries Index

Total number of teeth found with missed caries
Total number of teeth noted in I-A

Audit Form II. Record Review

A. Radiographic Assessment

1. Sufficient Quantity of Films — Number 'yes's / Number 'yes's plus number 'no's
2. Dated — same as above
3. Quality Problem Areas
   Insufficient Contrast
   Distortion
   Other, etc.
   — Number of ✓'s in each category / Total Records reviewed

Overall Quality — Number acceptable / Number acceptable plus number not acceptable

B. Dental Record Assessment

4. Patient Identification/ Registration Data
5. Medical History/ Dental History
6. Oral Exam
7. Charting
8. Treatment Plan
9. Progress Notes
10. Informed Consent
11. Periodontal Charting

— Number present **and** acceptable / Number present and acceptable plus number present plus number absent.

Audit Form III. Clinical Assessment

All elements, #'s 1 thru 24. — Number acceptable / Number acceptable plus number not acceptable

Summary — Number excellent / Total audits or Number Good / 'Total Audits', etc.

Audit Form IV. Assessment of Treatment

1. Completeness of Diagnosis
2. Non-dental considerations
3a. Appropriateness of Treatment
3b. Appropriateness of Preventive Care
4. Logical Sequence
5. Perception of Treatment

$$\frac{\text{Number acceptable}}{\text{Number acceptable plus Number not acceptable.}}$$

6. Summary of Treatment
7. Summary of Case Management

$$\frac{\text{Number excellent}}{\text{Total Audits}} \text{ or } \frac{\text{Number Good}}{\text{Total Audits}}, \text{ etc.}$$

Audit Form V. Infection Control Assessment

The infection control assessment is done on either a SITE or PRACTICE basis, NOT on a per patient basis.

1. Vaccination
2. Medical History
3. Barrier Techniques
4. Environmental Surfaces
5. Handwashing
6. Care of Shares
7. Sterilization
8. Care of Ultrasonics, Handpieces
9. Decontam. of Laboratory Supplies
10. Hazard Communication Program
11. Infectious Waste Disposal Policy
12. Written Policy Statement

There should be NO "not-acceptable" boxes checked, as each is an important element of dental infection control.

Summary/Each site or each practice will be judged to have either an Excellent, Good, Fair or Poor OVERALL infection control program.

Interpretation of Audit Results

The following printout is but one format by which audit results may be presented to the dentist or practice being reviewed. Because the results are derived from ratios of 'acceptable' to 'not-acceptable' findings, and presented as suggested percentages, they will be easily interpretable and understandable by all concerned parties.

Following are several formats by which the data can be interpreted and presented. They include:

- Mean and standard deviation of all practices involved
- Individual practice results compared to the mean and standard deviation of all practices involved in the quality review
- Comparison of results between all practices
- Results of Infection Control Assessment

REGION II DENTAL QUALITY ASSURANCE
SUMMARY OF CLINICAL ASSESSMENT
1990

PRINT DATE: 10/03/90

	CENTER G	MEAN	STAND DEV	MINIMUM	MAXIMUM
ORAL HEALTH STATUS					
Caries - missed	1.7	2.0	2.0	0.0	7.9
RADIOGRAPHIC ASSESSMENT					
Sufficient Quantity	94.3	86.3	20.5	20.0	100.0
Dated Properly	96.8	96.4	6.5	77.8	100.0
Problems in Quality:					
Contrast	0.0	5.2	16.7	0.0	83.3
Overlap	0.0	5.2	11.1	0.0	50.0
Distortion	3.1	7.6	14.8	0.0	71.4
Apex	0.0	4.5	8.1	0.0	28.6
Cone Cut	0.0	4.9	7.9	0.0	28.6
Developing	3.1	7.3	10.5	0.0	33.3
Other	3.1	2.4	4.4	0.0	16.7
Overall Quality	100.0	92.0	12.6	54.5	100.0
DENTAL RECORD ASSESSMENT					
Patient ID	97.1	99.9	0.6	97.1	100.0
Medical History	94.3	94.0	19.9	0.0	100.0
Oral Exam	97.1	83.6	31.4	0.0	100.0
Dental Charting	97.1	95.8	8.0	66.7	100.0
Tx Plan	97.1	80.4	27.4	20.0	100.0
Progress Notes	97.1	93.4	19.6	0.0	100.0
Informed Consent	96.4	82.0	31.2	0.0	100.0
Perio Charting	50.0	53.1	36.7	0.0	100.0
CLINICAL ASSESSMENT					
Operative:					
Margins	96.4	93.7	9.1	66.7	100.0
Contour	100.0	98.0	4.3	85.7	100.0
Contact Area	100.0	95.8	8.2	72.7	100.0
Occlusion	100.0	99.4	2.2	90.0	100.0
Surface	100.0	97.8	5.7	75.0	100.0
Crown and Bridge					
Margins	100.0	93.8	22.2	0.0	100.0
Ging. Contour	100.0	91.1	23.0	0.0	100.0
Embrasures	100.0	96.1	9.6	66.7	100.0
Pontic Cont.	100.0	97.0	7.0	75.0	100.0
Occlusion	100.0	97.0	8.0	66.7	100.0

REGION II DENTAL QUALITY ASSURANCE
SUMMARY OF CLINICAL ASSESSMENT
1990

PRINT DATE: 10/03/90

	CENTER G	MEAN	STAND DEV	MINIMUM	MAXIMUM
Endodontics					
Apical Fill (Obtur.)	100.0	99.3	3.1	85.7	100.0
Partial Dentures					
Stability	100.0	96.7	8.1	75.0	100.0
Retention	100.0	96.7	11.3	50.0	100.0
Occlusion	100.0	88.4	19.8	33.3	100.0
Extension	100.0	95.4	11.0	66.7	100.0
Design	100.0	98.8	5.4	75.0	100.0
Esthetics	100.0	98.0	6.0	80.0	100.0
Complete Dentures					
Stability	100.0	97.7	7.6	66.7	100.0
Retention	100.0	96.1	9.8	66.7	100.0
Occlusion	100.0	95.5	12.1	50.0	100.0
Extension	100.0	91.2	22.9	0.0	100.0
Vertical	100.0	100.0	0.0	100.0	100.0
Tissue	100.0	96.9	10.9	50.0	100.0
Esthetics	100.0	94.3	21.5	0.0	100.0
Clinical Summary					
Excellent	23.5	32.3	25.8	0.0	100.0
Good	70.6	58.8	24.6	0.0	100.0
Fair	5.9	8.2	13.7	0.0	59.1
Poor	0.0	0.6	2.2	0.0	9.1
ASSESSMENT OF TREATMENT					
Diagnosis	93.9	85.0	14.6	50.0	100.0
Non-dental	100.0	99.6	2.0	90.0	100.0
Approp. Tx	100.0	97.4	6.3	71.4	100.0
Approp. Prev.	100.0	91.7	13.0	50.0	100.0
Logical Tx	97.2	94.8	10.5	55.6	100.0
Perception	100.0	97.2	6.1	72.7	100.0
Assessment Summary					
Excellent	25.0	32.4	25.9	0.0	100.0
Good	66.7	57.6	24.1	0.0	100.0
Fair	8.3	9.2	13.0	0.0	40.9
Poor	0.0	0.8	2.9	0.0	14.3
CASE MANAGEMENT SUMMARY					
Excellent	25.0	31.2	27.0	0.0	100.0
Good	63.9	57.2	26.3	0.0	100.0
Fair	11.1	10.4	15.9	0.0	60.0
Poor	0.0	1.2	3.4	0.0	14.3

REGION II DENTAL QUALITY ASSURANCE - 1990
SUMMARY OF CLINICAL ASSESSMENT
(all figures in %)

PRINT DATE: 10/10/90

	CENTER A N =12	CENTER B N =15	CENTER C N = 8	CENTER D N =11	CENTER E N =10	CENTER F N = 9	CENTER G N =36	CENTER I N =14	CENTER J N = 6	CENTER K N =14
ORAL HEALTH STATUS										
Caries - missed	4.4	0.3	0.0	1.7	0.5	1.5	1.7	5.2	0.9	2.1
RADIOGRAPHIC ASSESSMENT										
Sufficient Quantity	100.0	86.7	100.0	100.0	100.0	62.5	94.3	100.0	100.0	78.6
Dated Properly	100.0	100.0	100.0	100.0	90.0	77.8	96.8	100.0	100.0	85.7
Problems in Quality:										
Contrast	0.0	0.0	0.0	0.0	0.0	14.3	0.0	0.0	83.3	7.1
Overlap	0.0	6.7	0.0	0.0	0.0	0.0	0.0	50.0	0.0	14.3
Distortion	0.0	0.0	0.0	0.0	0.0	14.3	3.1	71.4	0.0	14.3
Apex	0.0	20.0	0.0	0.0	0.0	14.3	0.0	28.6	0.0	7.1
Cone Cut	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	16.7	7.1
Developing	0.0	6.7	0.0	0.0	0.0	0.0	3.1	7.1	16.7	14.3
Other	0.0	0.0	0.0	9.1	0.0	0.0	3.1	7.1	16.7	7.1
Overall Quality	100.0	93.3	100.0	100.0	100.0	66.7	100.0	71.4	100.0	92.9
DENTAL RECORD ASSESSMENT										
Patient ID	100.0	100.0	100.0	100.0	100.0	100.0	97.1	100.0	N/A	100.0
Medical History	100.0	100.0	100.0	81.8	100.0	100.0	94.3	100.0	100.0	100.0
Oral Exam	100.0	100.0	100.0	100.0	100.0	33.3	97.1	100.0	100.0	100.0
Dental Charting	100.0	100.0	100.0	100.0	100.0	100.0	97.1	92.9	100.0	100.0
Tx Plan	100.0	100.0	87.5	100.0	100.0	22.2	97.1	92.9	100.0	100.0
Progress Notes	100.0	0.0	100.0	81.8	100.0	100.0	97.1	92.9	100.0	100.0
Informed Consent	100.0	100.0	100.0	100.0	100.0	44.4	96.4	92.9	N/A	100.0
Perio Charting	66.7	N/A	100.0	50.0	N/A	0.0	50.0	60.0	100.0	40.0
CLINICAL ASSESSMENT										
Operative:										
Margins	100.0	100.0	100.0	77.8	100.0	100.0	96.4	84.6	83.3	81.8
Contour	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Contact Area	100.0	100.0	100.0	100.0	100.0	80.0	100.0	72.7	100.0	100.0
Occlusion	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Surface	100.0	92.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Crown and Bridge										
Margins	100.0	100.0	100.0	100.0	100.0	N/A	100.0	100.0	100.0	100.0
Ging. Contour	100.0	100.0	80.0	100.0	100.0	N/A	100.0	66.7	100.0	100.0
Embrasures	100.0	100.0	80.0	100.0	100.0	N/A	100.0	66.7	100.0	100.0
Pontic Cont.	100.0	100.0	75.0	100.0	100.0	N/A	100.0	100.0	100.0	85.7
Occlusion	100.0	100.0	100.0	100.0	100.0	N/A	100.0	66.7	100.0	85.7

REGION II DENTAL QUALITY ASSURANCE - 1990
SUMMARY OF CLINICAL ASSESSMENT
(all figures in %)

PRINT DATE: 10/10/90

	CENTER A N =12	CENTER B N =15	CENTER C N = 8	CENTER D N =11	CENTER E N =10	CENTER F N = 9	CENTER G N =36	CENTER I N =14	CENTER J N = 6	CENTER K N =14
Endodontics										
Apical Fill (Obtur.)	100.0	N/A	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Partial Dentures										
Stability	100.0	N/A	75.0	100.0	100.0	100.0	100.0	100.0	100.0	75.0
Retention	100.0	N/A	100.0	100.0	100.0	100.0	100.0	100.0	100.0	50.0
Occlusion	100.0	N/A	50.0	100.0	100.0	100.0	100.0	60.0	100.0	75.0
Extension	100.0	N/A	100.0	100.0	100.0	100.0	100.0	100.0	66.7	75.0
Design	100.0	N/A	100.0	100.0	100.0	100.0	100.0	100.0	100.0	75.0
Esthetics	100.0	N/A	100.0	100.0	100.0	100.0	100.0	80.0	100.0	100.0
Complete Dentures										
Stability	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Retention	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Occlusion	75.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	80.0
Extension	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	60.0
Vertical	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Tissue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Esthetics	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	100.0	100.0
Clinical Summary										
Excellent	8.3	53.3	12.5	100.0	10.0	44.4	23.5	0.0	33.3	28.6
Good	91.7	46.7	75.0	0.0	90.0	55.6	70.6	83.3	66.7	57.1
Fair	0.0	0.0	12.5	0.0	0.0	0.0	5.9	16.7	0.0	7.1
Poor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1
ASSESSMENT OF TREATMENT										
Diagnosis	91.7	93.3	100.0	100.0	80.0	77.8	93.9	92.9	100.0	71.4
Non-dental	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Approp. Tx	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	92.9
Approp. Prev.	88.9	83.3	100.0	100.0	100.0	50.0	100.0	88.9	100.0	100.0
Logical Tx	100.0	100.0	100.0	100.0	100.0	55.6	97.2	100.0	100.0	78.6
Perception	100.0	100.0	100.0	100.0	100.0	88.9	100.0	92.9	100.0	92.9
Assessment Summary										
Excellent	8.3	53.3	12.5	100.0	10.0	22.2	25.0	7.1	33.3	28.6
Good	91.7	46.7	62.5	0.0	90.0	66.7	66.7	78.6	66.7	57.1
Fair	0.0	0.0	25.0	0.0	0.0	11.1	8.3	14.3	0.0	0.0
Poor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3
CASE MANAGEMENT SUMMARY										
Excellent	16.7	60.0	12.5	100.0	10.0	11.1	25.0	0.0	16.7	28.6
Good	83.3	40.0	75.0	0.0	80.0	66.7	63.9	85.7	83.3	57.1
Fair	0.0	0.0	12.5	0.0	10.0	22.2	11.1	14.3	0.0	0.0
Poor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3

REGION II DENTAL QUALITY ASSURANCE - 1990
ASSESSMENT OF INFECTION CONTROL PROGRAM (I.C.P.)
PRINT DATE: 10/10/90
Key: Acc = Acceptable; UnA = UnAcceptable

	CENTER A	CENTER B	CENTER C	CENTER D	CENTER E	CENTER F	CENTER G	CENTER I	CENTER J	CENTER K
Infection Control										
Vaccination (Hep. B)	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Medical History	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Barrier Techniques	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Environmental Surfaces	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Handwashing	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Use/Care of Sharps	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Steriliz./Disinfection	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Handpieces, Units, etc.	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Lab Materials	Acc	Acc	Acc	Acc	Acc	UnA	Acc	Acc	Acc	Acc
Hazard Communication Prog.	Acc	Acc	Acc	Acc	Acc	UnA	Acc	Acc	Acc	Acc
Inf. Waste Disp. Policy	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc	Acc
Written Office Policy	Acc	Acc	Acc	Acc	Acc	UnA	Acc	Acc	Acc	Acc
Overall Quality of I.C.P.	Good	Excel	Excel	Excel	Excel	Good	Excel	Good	Excel	Excel

Oral Disability Impact Patient Satisfaction Index (ODI/PSI)

Background

Outcome measures are usually defined in terms of mortality, morbidity, disability, social functioning, functional health status and patient satisfaction. However, these terms remain vague because they do not clarify the boundaries of health. Rates of mortality and morbidity do not tap the patient's level of physical, psychological symptoms and social adjustment. Nor do these rates consider the patient's satisfaction or dissatisfaction with the care provided. A survey of the literature on health status measures points out the need to very clearly define the terms used. The traditional perspective of disease, disability, discomfort, discontent and death has been the basis for the development of health status instruments as research has focused in recent years on the outcome of care.

Indices of patient functioning have been developed which try to classify functioning in terms of an individual's ability to perform everyday activities.[1-11] The Health Status Index views health as "a composite of an individual's level of function at a point in time and his expected transition to other levels, more or less favorable at future times."[12] This instrument uses a functional/dysfunctional approach to measuring the activities of daily living. It is an instrument which draws on the values of society in determining the standards for optimal physical and mental functioning. In this way, the Health Status Index hopes to adequately reflect the social parameters of health and act as "a comprehensive social indicator of health."

The Sickness Impact Profile (SIP) is an assessment of behavioral dysfunction during everyday activities, based on the assumption that sickness is a definition imposed by laypersons or the individual himself.[13] As such, the individual experiences the impact of the sick role whether or not he seeks medical care. It is when the individual enters the medical care process that his "sickness" may be defined as disease by the health care provider. Whether he seeks medical intervention or not, it is the individual's perception of the impact of sickness that is the basis for the SIP. The investigators of this outcome measure recognize that a single measure of health cannot present a complete assessment of the individual's profile of health. Therefore, they suggested that the SIP be used in conjunction with other health measures. The SIP looks at 14 categories of everyday activities and asks the respondent to react to 235 items on the basis of how the respondent feels at the time the SIP is administered. The reported findings on the correlations between clinician assessment of dysfunction and the SIP has indicated significant relationships between them.

In the Rand Health Insurance Study, several instruments were used to measure the patient's physical, mental, social and general health perceptions as a general statement of the facets of health status in a group.[14] The Health Perceptions Questionnaire measures eight perceptual areas of general health and sick role propensity; prior health, current health, health outlook, resistance/susceptibility to illness, health worry/concern, sickness orientation, rejection of sick role and attitude toward going to the doctor.[15] The results of the studies of relationships among these areas indicate three kinds of perceptions by patients: past/present health, future health or sick role propensity.

Development of the Index

There is little research in the area of outcome measures which consider the functional oral health status of patients in terms of how the patient perceives his disability, how he perceives the impact of oral problems in his life and why he seeks dental care. A health measure that can address these areas can be instrumental in the planning and delivery of dental care services to meet with more effectiveness the needs of the American public. Traditionally, the decisions as to the need for services have been defined by practitioners in the dental profession. Standards for the education of dental personnel have been developed to improve the quality of the services provided to the public without periodic reviews as to the need for those services. Current demands for accountability and control in health care expenditures makes it imperative that the dental services offered are reflective of the true needs of the public. It may very well be that the public is not aware of what oral problems they have or which ones can be alleviated. An instrument that can crystalize these problem areas serves both to raise the public's level of dental consciousness and to stress those areas upon which educators need to focus.

The development of an instrument that would measure the impact of dental problems on an individual's life is based on certain assumptions made by the research team. One, that there are indeed dental problems, as perceived by an individual, that have bearing on various aspects of daily living. Two, that individuals experiencing these problems do not necessarily define themselves as sick nor do they take on the sick role when their oral problems are diagnosed as dental disease.

Many health status measures were examined in the process of selecting items that could be related to dental problems. From the 14 categories used in the SIP instrument, six categories were viewed as most likely to afford opportunities for the individual to perceive oral problems as dysfunctional. The decision to use these categories relies heavily on the dental experience of the research team and their knowledge of the social world. These six categories were: sleep and rest activities; work, home and school activities; social interaction; eating and communication. It was decided to incorporate restricted activity days, from the National Health Interview Study, so as to probe further the extent disability might have on normal functioning.

Based on the assumption that individuals seek dental care because they are in pain, are not able to eat or function normally, or want to look better, a matrix was set up that would look at the item in each of the six categories along three dimensions: pain, function and esthetics. To complete the instrument, questions on patient satisfaction/dissatisfaction were included.

The Oral Disability Impact/Patient Satisfaction Index (ODI/PSI) is self administered by each patient who presents himself at the office for a clinical assessment. Each ODI/PSI measure is coded so as to protect the patient's anonymity and insure confidentiality.

Procedure for Administering Oral Disability Impact and Patient Satisfaction Index

Purpose:

This questionnaire has been developed to assess the impact of dental disease and its sequelae on the functional status of dental consumers. It also serves to correlate the level of patient satisfaction with the quality of dental care as rendered by the attending dentist.

Functional status can be defined as the capacity or ability to do a number of activities considered normal for an individual in the performance of everyday living.

Each questionnaire can be pre-coded with the dentist's code and the patient code in an effort to assure confidentiality. The patient's name will not appear on the questionnaire.

Materials:

- Oral Disability Impact and Patient Satisfaction Index (ODI/PSI).
- Pre-addressed, stamped envelope.

Procedure:

1. For patients who appear for the audit:
   - After the patient has filled out the Patient Registration Form, a pre-coded questionnaire is given to the patient to be completed.
   - The completed questionnaire is collected by the office manager before the patient is examined by the reviewer.
2. Patients needing assistance in filling out the ODI/PSI questionnaire will be helped by the office manager.

   Parents, guardians, or a consenting adult will be asked to assist the child patient in filling out the ODI/PSI questionnaire.

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Dental Quality Assurance Patient Questionnaire ODI/PSI

DENTAL QUALITY ASSURANCE

1	2	–	3	4

This questionnaire has been designed to find out how you feel your oral health has affected your life in certain areas. Your cooperation in answering to the best of your ability will help your dentist improve the quality of the dental services he provides.

Rate by CIRCLING the *degree of impact* the areas in the following questions have had on your life from: 1 (none at all) 2 3 4 5 6 (a great deal)

Please feel free to share some comments with us. Thank you.

5 Rate the degree of impact the pain and/or discomfort of dental problems have had on your work, school or household activities? 1 2 3 4 5 6 (none at all / a great deal)

Comment:

6 Rate the degree of impact the LOSS of oral functions (interference with speech and/or interference with eating) due to dental problems has had on your work, school, or household activities? 1 2 3 4 5 6 (none at all / a great deal)

Comment:

7 Rate the degree of impact being UNHAPPY with how your teeth/gums/face/jaws looked has had on your work, school or household chores 1 2 3 4 5 6 (none at all / a great deal)

Comment:

8 Did you ever have to stay home from a social event because of pain or discomfort in your teeth or gums? If yes, rate the degree of impact? 1 2 3 4 5 6 (none at all / a great deal)

Comment:

9 Have you AVOIDED social events and people because your dental problems or dental work interfered with your speech or eating? If yes, rate the degree of impact. 1 2 3 4 5 6 (none at all / a great deal)

Comment:

10 Have you AVOIDED people because you felt embarrassed or unhappy with how your teeth and/or gums looked? If yes, rate the degree of impact. 1 2 3 4 5 6 (none at all / a great deal)

Comment:

11 Have you had to CHANGE eating habits, or diet because you could not chew or were afraid of loosening, breaking or disturbing any dental work? If yes, rate the degree of impact? 1 2 3 4 5 6 (none at all / a great deal)

Comment:

12 Have you ever CHANGED your diet or eating habits because of pain or discomfort from dental procedures or mouth problems? If yes, rate the degree of impact? 1 2 3 4 5 6 (none at all / a great deal)

Comment:

13 Has your sleep or rest ever been disrupted because of an inability to close your mouth due to dental problems? If yes, rate degree of impact? 1 2 3 4 5 6 (none at all / a great deal)

Comment:

14 Has you sleep ever been affected because of pain or discomfort from dental problems or dental work? If yes, rate the degree of impact?

1 2 3 4 5 6
none at all — a great deal

Comment:

---

15 Have you ever had trouble with your speech because of dental work, loss of teeth or other dental problems UNRELATED to pain or discomfort? If yes, rate the degree of impact.

1 2 3 4 5 6
none at all — a great deal

Comment:

---

16 Have you ever AVOIDED normal conversation because of dental work, unattractive teeth/gums or bad breath? If yes, rate the degree of impact?

1 2 3 4 5 6
none at all — a great deal

Comment:

---

17 Did you ever LIMIT your facial expression, afraid to laugh, afraid to smile/grin because of unattractive teeth, gums or dental work? If yes, rate the degree of impact?

1 2 3 4 5 6
none at all — a great deal

Comment:

Please answer the following questions as best you can:

Has the pain and/or discomfort of dental problems caused you to LOSE days DURING THIS PAST YEAR from work, school or household activities?

18-20 IF YES, how many days from WORK _____

21-23 how many days from SCHOOL _____

24-26 how many days from HOUSEHOLD ACTIVITIES _____

Comment:

Has the pain and/or discomfort of dental problems caused you to LIMIT your activities DURING THIS PAST YEAR?

27-29 IF YES, how many days at WORK _____

30-32 how many days at SCHOOL _____

33-35 how many days at HOUSEHOLD ACTIVITIES _____

Comment:

Have you LOST days from your work, school, household activities because you were UNHAPPY with how your teeth/gums/face/jaws looked DURING THIS PAST YEAR?

36-38 IF YES, how many days from WORK _____

39-41 how many days from SCHOOL _____

42-44 how many days from HOUSEHOLD ACTIVITIES _____

Comment:

Have you ever LIMITED your activities at work, school, home, because you were UNHAPPY with how your teeth/gums/face/jaws looked DURING THIS PAST YEAR?

45-47 IF YES, how many days at WORK _____

48-50 how many days at SCHOOL _____

51-53 how many days at HOUSEHOLD ACTIVITIES _____

Comment:

Have you ever LOST days from your, school, household activities because of the LOSS or oral functions (you could not speak, you could not eat) DURING THIS PAST YEAR, due to dental problems?

54-56 IF YES, how many days from WORK _____

57-59 how many days from SCHOOL _____

60-62 how many days from HOUSEHOLD ACTIVITIES _____

Comment:

Have you ever had to LIMIT your activities–work, school, home, because of the LOSS or oral functions (you could not eat, or you could not speak) DURING THIS PAST YEAR due to dental problems?

63-65 IF YES, how many days from WORK _____

66-68 how many days from SCHOOL _____

69-71 how many days from HOME _____

Comment:

Please CIRCLE how you feel in response to each question from 1 not at all 2 3 4 5 6 very much so

---

72 Do you believe your dentist does all he can DURING THE OFFICE VISIT so you do not feel pain or discomfort? 1 not at all 2 3 4 5 6 very much so

Comment:

---

73 Do you believe your dentist does all he can so you do not feel pain or suffer AFTER THE OFFICE VISIT? 1 not at all 2 3 4 5 6 very much so

Comment:

---

74 Do you believe your dentist does all he can to keep your mouth in good functioning order? 1 not at all 2 3 4 5 6 very much so

Comment:

---

75 Are you happy with how your teeth and gums look? 1 not at all 2 3 4 5 6 very much so

Comment:

---

76 Would you recommend your dentist to your friends? 1 not at all 2 3 4 5 6 very much so

Comment:

---

77 Do you believe your dentist did all he could to allay your fears and anxiety? 1 not at all 2 3 4 5 6 very much so

Comment:

---

78 Do you find that your dentist does not explain things to you? 1 not at all 2 3 4 5 6 very much so

Comment:

---

79 Do you feel confident in the care your dentist gives you? 1 not at all 2 3 4 5 6 very much so

Comment:

---

80 Do you feel the condition of your mouth has improved since you began treatment? 1 not at all 2 3 4 5 6 very much so

Comment:

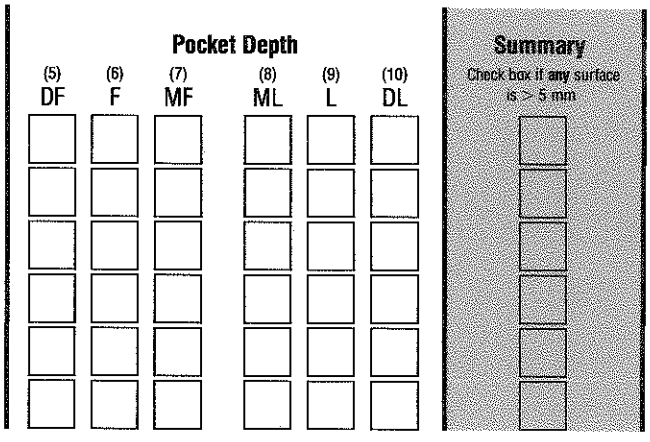
Appendix A:

Abbreviated Oral Health Status Methodology

Abbreviated Oral Health Status Methodology

An abbreviated methodology you may wish to utilize in order to assess whether the practitioner had an awareness of the presence or absence of periodontal disease has been developed. It is generally recognized that pockets greater than 5mm. are cause for concern and intervention. Using this simplified measure may decrease audit time as well as serve to correlate the readings with the presence or absence of periodontal treatment when indicated.

If you elect to utilize the abbreviated format you need only make use of the shaded column labeled "Summary." DO NOT complete the Oral Hygiene or Gingival Index. You need only check the sample teeth and "Summary" box if any surface probed is greater than 5mm. Remember to probe all six surfaces: DF, F, MF, ML, L, and DL. If one or more surfaces is found to have a pocket depth of 5mm or greater, place a check (✓) in the Summary box for that tooth.



Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

DATE ☐☐ MONTH ☐☐ DAY ☐☐ YEAR

REVIEWER _____

REVIEWER NUMBER ☐☐☐

NAME OF PRACTICE/SITE _____

PATIENT NAME _____

PATIENT NUMBER ☐☐☐☐☐☐☐

AGE ☐☐

I: ORAL HEALTH STATUS INDICATORS

Instructions: This section applies to persons who are dentulous. If the person is completely edentulous, check the box NOT APPLICABLE below and go to next section.

☐ Not Applicable

If the person is dentulous, continue below.

A. Count the number of teeth and place in box.

Total number of teeth ☐☐

B. Oral Hygiene/Periodontal Indicators

Evaluate the sample teeth and surfaces indicated below for each of the three indicators *for persons 13 years and older.*
Evaluate the Oral Hygiene and Gingival Indicators *only for persons 12 years and under.*
If a tooth is missing, DO NOT evaluate another tooth. Leave the boxes for that tooth blank.

Scale	
Oral Hygiene Index	0 = no continuous plaque 1 = continuous plaque
Pocket Depth	Write depth measured to the nearest millimeter in appropriate box. If one or more surfaces > 5 mm, place (√) in summary box.
Gingival Index	0 = no bleeding within 30 seconds 1 = bleeding within 30 seconds

Surface Code

D = distal
M = mesial
F = facial
L = lingual

Tooth	Oral Hygiene				Pocket Depth						Summary	Gingival			
	DF	(2) F	(3) MF	(4) L	(5) DF	(6) F	(7) MF	(8) ML	(9) L	(10) DL	Check box if any surface is > 5 mm	(11) DF	(12) F	(13) MF	(14) L
3 (A)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8 (E)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13 (I)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19 (K)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24 (O)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
28 (T)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

C. Caries Index

Place a Check (✓) in the box below the tooth that has new or recurrent caries and/or fractured teeth not restored where there is dentinal involvement.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

A	B	C	D	E	F	G	H	I	J
T	S	R	Q	P	O	N	M	L	K

Appendix B:

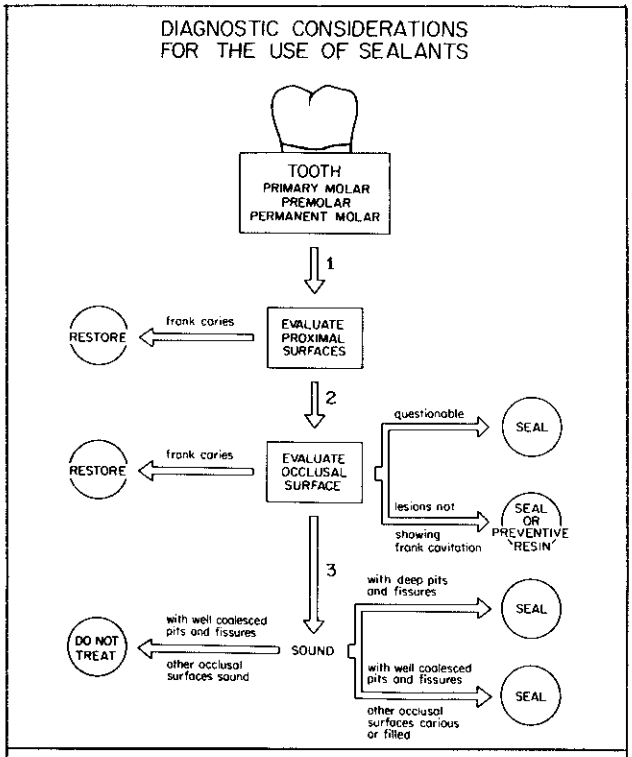
Criteria for the Use of Pit and Fissure Sealants

Tooth-Oriented Criteria for the Use of Pit and Fissure Sealants in Individual Care Programs

Diagnosis of Occlusal Surface	Clinical Considerations	Do Seal	Do Not Seal
Sound	occlusal morphology	deep, narrow pits and fissures	broad, well-coalesced pits and fissures
	status of proximal surface (s)	sound	frank caries
	general caries activity	many occlusal lesions, few proximal lesions	many proximal lesions*
Questionable	status of proximal surface (s)	sound	frank caries
	general caries activity	many occlusal lesions, few proximal lesions	many proximal lesions*
Carious	occlusal anatomy	if pits or fissures are separated by a transverse ridge, a sound pit or fissure may be sealed	pits or fissures with frank lesions

*unless other preventive measures are instituted

Criteria for the Use of Pit and Fissure Sealants



Diagnostic flow chart for all occlusal surfaces and for lingual grooves of maxillary molars that extend from the occlusal surface. Buccal pits of mandibular molars and lingual pits of maxillary molars enter chart at arrow number two. (Substitute the appropriate surface for "Occlusal"). When using the chart, it is assumed that the patient is receiving appropriate fluoride therapy.

Appendix C:

U.S. Preventive Services Task Force Guide to Clinical Preventive Services

U.S. Preventive Services Task Force Ratings

Task Force Ratings

The tables of ratings on the following pages were developed by the U.S. Preventive Services Task Force between July 1984 and February 1988 using a methodology adapted from the Canadian Task Force on the Periodic Health Examination.* They do not reflect more recently published evidence. The U.S. Task Force did not develop ratings for all the topics examined in the *Guide*. In addition, some of the interventions listed in these tables (and indicated by a caret [^] were rated during Task Force deliberations but are not discussed in the text of the *Guide*.

The Task Force graded the *strength of recommendations* for or against preventive interventions as follows:

Strength of Recommendations

A: There is good evidence to support the recommendation that the condition be specifically considered in a periodic health examination.
B: There is fair evidence to support the recommendation that the condition be specifically considered in a periodic health examination.
C: There is poor evidence regarding the inclusion of the condition in a periodic health examination, but recommendations may be made on other grounds.
D: There is fair evidence to support the recommendation that the condition be excluded from consideration in a periodic health examination.
E: There is good evidence to support the recommendation that the condition be excluded from consideration in a periodic health examination.

Determination of the quality of evidence (i.e., "good," "fair," "poor") in the strength of recommendations above was based on a systematic consideration of three sets of criteria: the burden of suffering from the target condition, the characteristics of the intervention, and the effectiveness of the intervention as demonstrated in published research. Effectiveness of the intervention received special emphasis. In reviewing clinical studies, the Task Force used strict criteria for selecting admissible evidence and placed special emphasis on the quality of study designs. In grading the *quality of evidence*, the Task Force gave special weight to those study designs that, for methodologic reasons, are less subject to bias and inferential error. The following rating system was used:

Quality of Evidence

I: Evidence obtained from at least one properly-designed randomized controlled trial.
II-1: Evidence obtained from well-designed controlled trials without randomization.
II-2: Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group.
II-3: Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940's) could also be regarded as this type of evidence.
III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

*Canadian Task Force on the Periodic Health Examination. The periodic health examination. Can Med Assoc J 1979; 121:1193–254.

Preventive Dentistry

Preventive Intervention	Quality of Evidence	Strength of Recommendations
Caries		
Fluoride		
Systemic—water fluoridation, dietary supplements	I	A
Topical—self-applied (dentifrice, mouthrinse), professionally applied	I	A
Occlusal sealants	I	A
Dietary control		
Limit sweets	II-1	A
Avoid bedtime baby bottle containing cariogenic liquid	III	B
Personal oral hygiene (tooth brushing without fluoride, flossing)	III	C
Periodic dental examination	III	C
Periodontal Disease		
Plaque and calculus control		
Personal oral hygiene	I	A
Professional care scaling and root planing, prophylaxis in combination with personal oral hygiene	I	A
Chlorhexidine (antiplaque agent) (high-risk groups only)^	I	A
Periodic dental examination	III	C
Malocclusion		
Space maintenance after loss of deciduous teeth^	II-2	B
Ceasing of finger- and thumb-sucking habits by age 6 y^	III	C
Maintenance of open airway while orofacial area is developing^	III	C
Trauma		
Mouthguards with contact sports^	II-3	A
Shoulder and lap safety belts in cars	II-3	A
Helmets and face shields while riding motorcycles	III	C
Helmets and mouthguards with skateboards^	III	C
Oral Cancer		
Avoidance of tobacco		
Smoking	II-2	A
Smokeless	II-2	A
Annual oral examination to detect premalignant and malignant lesions and to assess risk factors and provide counseling	III	C

^Examined by Task Force but not discussed in *Guide*.

Appendix D:

Infection Control Criteria

The references that follow should be well known to all practicing dentists. They are the source material from which all Part V: Infection Control Assessment Criteria have been drawn. Should you have any questions regarding the interpretation of these criteria, please refer to the appropriate reference.

- Recommended Infection Control Practices for Dentistry *Morbidity and Mortality Weekly Report*, Centers for Disease Control, April 18, 1986.
- Infection Control: Fact and Reality, *American Dental Association*, 1988.
- Hazards Communication Program. *American Dental Association*, Sept 19, 1988.
- Infectious Waste Disposal in the Dental Office. *American Dental Association*, August, 1989.
- A Dentists Guide to Aids: Issues in the Dental Office. *New York State Department of Health*, May, 1989.
- Runnels, R. R. Practical How Tos of Dental Infection Control. *Infection Control Publications*, North/Salt Lake, Utah, 1987.

Appendix E:

Audit Forms

The following forms may be removed from the manual and reproduced for use in various practice sites.

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

DATE ☐☐ MONTH ☐☐ DAY ☐☐ YEAR

REVIEWER _____

REVIEWER NUMBER ☐☐☐

NAME OF PRACTICE/SITE _____

PATIENT NAME _____

PATIENT NUMBER ☐☐☐☐☐☐☐

AGE ☐☐

I: ORAL HEALTH STATUS INDICATORS

Instructions: This section applies to persons who are dentulous. If the person is completely edentulous, check the box NOT APPLICABLE below and go to next section.

☐ Not Applicable

If the person is dentulous, continue below.

A. Count the number of teeth and place in box.

Total number of teeth ☐☐

B. Oral Hygiene/Periodontal Indicators

Evaluate the sample teeth and surfaces indicated below for each of the three indicators *for persons 13 years and older.*
Evaluate the Oral Hygiene and Gingival Indicators *only for persons 12 years and under.*
If a tooth is missing, DO NOT evaluate another tooth. Leave the boxes for that tooth blank.

Scale	
Oral Hygiene Index	0 = no continuous plaque 1 = continuous plaque
Pocket Depth	Write depth measured to the nearest millimeter in appropriate box. If one or more surfaces > 5 mm, place (✓) in summary box.
Gingival Index	0 = no bleeding within 30 seconds 1 = bleeding within 30 seconds

Surface Code

D = distal
M = mesial
F = facial
L = lingual

Tooth	Oral Hygiene (2) DF	(3) F	(4) MF	L	Pocket Depth (5) DF	(6) F	(7) MF	(8) ML	(9) L	(10) DL	Summary Check box if any surface is > 5 mm	Gingival (11) DF	(12) F	(13) MF	(14) L
3 (A)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8 (E)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13 (I)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19 (K)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24 (O)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
28 (T)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

C. Caries Index

Place a Check (✓) in the box below the tooth that has new or recurrent caries and/or fractured teeth not restored where there is dentinal involvement.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

A	B	C	D	E	F	G	H	I	J
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
T	S	R	Q	P	O	N	M	L	K
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

PATIENT NAME _____

II: RECORD REVIEW

Instructions: Review the chart for the following criteria. Check (✓) the appropriate answer for each of the criteria below.

A. Radiographic Assessment

Review all radiographs taken during the last 5 years. If there is no radiographic survey taken during this time, use the most recent set in evaluating the first criteria.

	ACCEPTABLE	NOT ACCEPTABLE
1. Sufficient QUANTITY of films in last full mouth survey.	(1) ☐	(2) ☐
2. Evidence of a date on all films taken within last 5 years	(1) ☐	(2) ☐

3. QUALITY-check problem areas

- ☐ Insufficent contrast
- ☐ Distortion (elongation, foreshortening)
- ☐ Cone cut
- ☐ Other _____ SPECIFY
- ☐ Overlapping images
- ☐ Apex and surrounding bone not shown
- ☐ Poor developing

OVERALL estimation of QUALITY of x-rays taken within last 5 years	(1) ☐	(2) ☐

B. Dental Record Assessment

Check all criteria if present or absent.
If present, check if acceptable or not acceptable using definitions in review manual.

	PRESENT	ABSENT	ACCEPTABLE	NOT ACCEPTABLE
4. Patient Identification/Registration Data	(1) ☐	(2) ☐	(1) ☐	(2) ☐
5. Medical History/Dental History	(1) ☐	(2) ☐	(1) ☐	(2) ☐
6. Extra Oral/Intra Oral Examination	(1) ☐	(2) ☐	(1) ☐	(2) ☐
7. Dental Charting	(1) ☐	(2) ☐	(1) ☐	(2) ☐
8. Treatment Plan	(1) ☐	(2) ☐	(1) ☐	(2) ☐
9. Progress Notes	(1) ☐	(2) ☐	(1) ☐	(2) ☐
10. Informed Consent	(1) ☐	(2) ☐	(1) ☐	(2) ☐

11. Periodontal Charting

If the patient exhibits a pocket of 5 millimeters or more on one tooth or more in the Health Status Section on preceding page, check presence or absence of periodontal charting. If present, check whether acceptable or not acceptable. Check NOT APPLICABLE, only if there are no pockets of 5mm or more.

NOT APPLICABLE	PRESENT	ABSENT	ACCEPTABLE	NOT ACCEPTABLE
(1) ☐	(2) ☐	(3) ☐	(1) ☐	(2) ☐

Comments:

_____

_____

_____

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

PATIENT NAME _____

III: CLINICAL ASSESSMENT

Instructions: Review each of the criteria. Check (✓) acceptable or not acceptable if the criteria conform to the definitions provided in the review manual. For the first three categories (Operative, Crown & Fixed Prosthodontics, Endodontics), rate the criteria not acceptable if at least one tooth is judged not acceptable. Specify teeth and appliance judged not acceptable. If criteria not acceptable, indicate as such. More than 5 teeth found not acceptable should be noted in comment section.

Operative	NOT APPLICABLE	ACCEPTABLE	NOT ACCEPTABLE	SPECIFY TEETH EVALUATED AND NOT ACCEPTABLE
1. Marginal Integrity	(1) ☐	(2) ☐	(3) ☐	
2. Contour of Gingival Margins	(1) ☐	(2) ☐	(3) ☐	
3. Contact Areas	(1) ☐	(2) ☐	(3) ☐	
4. Occlusion	(1) ☐	(2) ☐	(3) ☐	
5. Surface	(1) ☐	(2) ☐	(3) ☐	
Crown and Fixed Prosthodontics				
6. Marginal Integrity	(1) ☐	(2) ☐	(3) ☐	
7. Gingival Contour	(1) ☐	(2) ☐	(3) ☐	
8. Embrasures	(1) ☐	(2) ☐	(3) ☐	
9. Gingival Contour of Pontic	(1) ☐	(2) ☐	(3) ☐	
10. Occlusion	(1) ☐	(2) ☐	(3) ☐	
Endodontics				
11. Apical Fill (Obturation)	(1) ☐	(2) ☐	(3) ☐	

Removable Prosthodontics / **Partial Dentures**	NOT APPLICABLE	ACCEPTABLE	NOT ACCEPTABLE	SPECIFY APPLIANCE(S) EVALUATED NOT ACCEPTABLE	
12. Stability	(1) ☐	(2) ☐	(3) ☐	PL	PU
13. Retention	(1) ☐	(2) ☐	(3) ☐	PL	PU
14. Occlusion	(1) ☐	(2) ☐	(3) ☐	PL	PU
15. Extension/Tissue Adaptation	(1) ☐	(2) ☐	(3) ☐	PL	PU
16. Design & Framework	(1) ☐	(2) ☐	(3) ☐	PL	PU
17. Esthetics	(1) ☐	(2) ☐	(3) ☐	PL	PU
Complete Dentures					
18. Stability	(1) ☐	(2) ☐	(3) ☐	FL	FU
19. Retention	(1) ☐	(2) ☐	(3) ☐	FL	FU
20. Occlusion	(1) ☐	(2) ☐	(3) ☐	FL	FU
21. Extension	(1) ☐	(2) ☐	(3) ☐	FL	FU
22. Vertical Dimension	(1) ☐	(2) ☐	(3) ☐	FL	FU
23. Tissue Adaptation	(1) ☐	(2) ☐	(3) ☐	FL	FU
24. Esthetics	(1) ☐	(2) ☐	(3) ☐	FL	PU

Summary

Indicate in general the overall quality of the clinical work. (1) ☐ Excellent (2) ☐ Good (3) ☐ Fair (4) ☐ Poor

Comments: _____

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

PATIENT NAME _____

IV: ASSESSMENT OF TREATMENT

Instructions: Review the patient and chart for the first four criteria. Use judgement for the overall assessment of each of these five criteria using the specific areas listed under each criteria as a guide.

1. Completeness of Diagnosis Check problems overlooked or not noted in treatment

☐ Caries ☐ Gingivitis ☐ Periodontitis
☐ Missing Teeth ☐ TMJ/Facial Pain ☐ Oro/Facial Pathology
☐ Periapical Pathology ☐ Malocclusion ☐ Problems of Space Maintenance in children

Assessment of Diagnosis: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

2. Integration of Non-dental Considerations Review chart and interview patient about non-dental problems. Check areas not appropriately considered in treatment.

☐ Medical ☐ Emotional ☐ Drug Related ☐ Lifestyle

Assessment of Non-dental Considerations: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

3a. Appropriateness of Treatment Check services considered inappropriate

☐ Restorative ☐ Periodontics ☐ Endodontics
☐ Removable Prosthodontics ☐ Fixed Prosthodontics ☐ Pulp Protection
☐ Oral Surgery ☐ Orthodontics/Space Maintenance ☐ Medication Prescribed
☐ Other _____ SPECIFY

Assessment of Appropriateness of Treatment: (1) ☐ Acceptable (2) ☐ Not Acceptable

3b. Appropriateness of Preventive Care Review preventive care in chart

Assessment of Appropriateness of Preventive Care including sealants: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

4. Logical Sequence of Treatment Review progess notes and treatment plan in chart. Check areas that are not judged to be in proper sequence.

☐ Pain Control ☐ Caries Control ☐ Pulpal Therapy
☐ Preventive Services ☐ Malocclusion ☐ Periodontal Disease Control
☐ Space Maintenance ☐ Surgical Treatment ☐ Restoration of Missing Teeth
☐ Other _____ SPECIFY

Assessment of Logical Sequence of Treatment: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

5. Patient's Perception of Treatment Question patient on satisfaction in each of the following areas. Check problem areas.

☐ Comfort ☐ Esthetics ☐ Function ☐ Satisfaction With Dentist

Assessment of Patient's Perception of Treatment: (1) ☐ Acceptable (2) ☐ Not Acceptable

Comments: _____

6. Summary of Treatment Indicate in general the overall quality of treatment

Excellent (1) ☐ Good (2) ☐ Fair (3) ☐ Poor (4) ☐

Comments: _____

7. Summary of Case Management Indicate the overall quality of the total management of patient care. Review the chart, clinical, and treatment components before making a final assessment.

Excellent (1) ☐ Good (2) ☐ Fair (3) ☐ Poor (4) ☐

Dental Quality Assurance Audit Form

DENTAL QUALITY ASSURANCE

PATIENT NAME _____

V: Infection Control Assessment

Check criteria if acceptable or not acceptable using definitions in the manual (See Appendix D)

A. Infection Control

	ACCEPTABLE	NOT ACCEPTABLE	COMMENT REFERENCE
1. Vaccination (Hepatitis)	(1) ☐	(2) ☐	_____
2. Medical History	(1) ☐	(2) ☐	_____
3. Barrier Techniques (Gloves, Masks, Gowns, Eyewear)	(1) ☐	(2) ☐	_____
4. Environmental surface protection	(1) ☐	(2) ☐	_____
5. Handwashing/Care of Hands	(1) ☐	(2) ☐	_____
6. Use and care of sharp instruments and needles	(1) ☐	(2) ☐	_____
7. Sterilization and Disinfection	(1) ☐	(2) ☐	_____
8. Use and care of ultrasonic scalers, handpieces & dental units	(1) ☐	(2) ☐	_____
9. Decontamination of laboratory supplies and materials	(1) ☐	(2) ☐	_____

B. Hazard Communication Program

10. Hazard Communiclation Program	(1) ☐	(2) ☐	_____

C. Infectious Waste Disposal

11. Infectious waste disposal policy	(1) ☐	(2) ☐	_____

D. Statement of Office Policy

12. Written statement of office policy	(1) ☐	(2) ☐	_____

Summary:

Indicate in general the overall quality of the Infection Control Program.

(1) ☐ Excellent (2) ☐ Good (3) ☐ Fair (4) ☐ Poor

Comments/Reference:

_____

_____

_____

Section III: *Annotated Bibliography and Bibliography*

Annotated Bibliography

This annotated bibliography and bibliography for all twenty-four clinical assessment criteria has been developed by the authors with the following purposes in mind:

1. To demonstrate via the literature (wherever possible) the relationship between each criteria and dental health status outcomes.
2. To serve as an educational resource and handy reference tool.
3. To serve as a review and reinforcement for the criteria utilized in this study.
4. To present state of the art information in each of the criteria that may aid you as both reviewers and practitioners of dentistry.

Operative/ Criterion 1: Marginal Integrity

Gortil, C., Nordenberg, D., Liberman, R., and Ben-Amar, A.: The effect of ultrasonic cleaning and air polishing on the marginal integrity of radicular amalgam and composite resin restorations. *J. Clin. Periodontol* 16:137-9, 1989

In view of the importance of regular prophylaxis in the prevention, treatment, and maintenance of patients with inflammatory periodontal diseases, information regarding possible adverse effects of various techniques on teeth, restorations, and soft tissues is of major clinical importance. Ultrasonic cleaning and air abrasive polishing caused no detrimental effect on the marginal integrity of radicular amalgam and composite resin restorations when evaluated by clinical and microleakage methods.

Scherer, W., Lippman, N., and Kaim, J.: Antimicrobial properties of glass ionomer cements and other restorative materials. *J Oper Dent* 14:77-81, 1989

The antimicrobial activity of 14 restorative materials, including glass ionomer cements, were examined by use of cariogenic bacteria and measured zones of inhibition. The glass ionomer cements and materials containing zinc oxide and amalgam produced measurable inhibition zones.

Phillips, R. W.: Changing trends of dental restorative materials. *Dent. Clin. North Am.* 1989 Apr;33(2):285–91.

Esthetic dentistry evolved through advancements in dental materials and techniques. This article cites these trends, particularly the adhesive systems such as dentin bonding agents and polyacrylic acid based materials. In particular, the expanding role of glass ionomer cements is explored with attention to the various formulations and manipulative factors that influence performance. Also, a classification system for composite resins is offered with suggestions for proper selection.

Wenner, K. K. et al.: Microleakage of root restorations. *J. Am. Dent Assoc.* 1988 Dec; 117(7):825–8.

This study evaluated the microleakage of various restorative materials placed in root surfaces. A minimum of 20 freshly extracted single-rooted teeth were used for each combination of restorative materials. Four preparations were made on the root surface and each restored with a different material. After thermocycling in dye, the root was cut transversely in several sections through the restoration, and microscopically examined to record the microleakage at the interface between restorative materials and tooth. Results indicated that fewer composite resin specimens allowed microleakage into dentin as compared with either amalgam or glass ionomer materials.

Maryniuk, G. A., and Kaplan, S. H.: Longevity of restorations: survey results of dentists' estimates and attitudes. *J. Am. Dent Assoc.* 1986 Jan:112(1):39–45.

A cross-sectional survey of 571 clinicians was conducted to obtain information about expected and observed restoration longevity. Clinicians believed that average large amalgam, small amalgam, and cast restorations lasted 6, 11, and 13 years, respectively. Patients were thought to be responsible for 47%, dentists for 30%, and materials used for 23% of restoration failures. The clinicians perceived the restorations that they placed to be more long-lasting than those placed by other clinicians. Clinical measurements of restoration longevity were shown to be influenced by the judgment criteria used by clinicians.

Goldberg, J., Tanzer, J., Munster, E., Amara, J., Thal, F, and Birkhed, D.: Cross-sectional clinical evaluation of recurrent enamel caries, restoration of marginal integrity, and oral hygiene status. *J. Am. Dent. Assoc.* 102:635, 1981.

This investigation in which 2,300 teeth in 87 American patients were examined found that, of the 914 teeth with restorations, the incidence of recurrent caries on restored surfaces was 16.2%. When the marginal discrepancies of the restorations were evaluated on a scale of 1 to 11, from the least to the greatest, respectively, the average was found to be 4.8, with the incidence of caries increasing sharply with decreasing marginal integrity. The quality of the oral hygiene had a similar effect.

Dahl, J. E., Eriksen, H. M.: Reasons for replacement of amalgam dental restorations. *Scand J. Dent. Res.* 86:404, 1978.

Two hundred class 2 amalgam restorations of unknown age and past history were analyzed for the reasons of need for replacement. Caries in association with marginal fractures was found in connection with 18 percent of all the restorations investigated.

Going, R. E.: Microleakage around dental restorations: a summarizing review. *J. Am. Dent Assoc.* 84:1349, 1972.

The author reviewed several articles related to the causes of microleakage around restorations. These include flushing cavity preparations with cleansing and sterilization agents, thermal expansion of restorative materials, defective enamel at the margins, and poor adaptation of the restorative material. He cites but does not document evidence that microleakage around dental restorations is implicated with such problems as: hastening of the breakdown and dissolution of certain materials, post operative sensitivity, chronic hypersensitivity, tooth discoloration under restorations, recurrent caries, and pulp pathology.

Jorgensen, K. D., Wakumato, S.: Occlusal amalgam fillings: Marginal defects and secondary caries. *Odontol Tidskrift* 76:43, 1968.

This study evaluated the relationship of recurrent caries to marginal defects of occlusal amalgam restorations on extracted lower first permanent molars. Caries was seen only where the amalgam defect was 50 microns or greater. The caries rate increased in proportion to the size of the fracture. Fifteen percent of all amalgam fractures were associated with recurrent caries. Of these, 2.7 percent of the defects were carious when the size of the fracture fell between 50 to 74 microns and 63 percent of the defects greater than 500 microns were carious. The greatest number of recurrent caries was associated with defects in the areas of fissures and grooves of the occlusal surface. The authors related these defects to fractures of excess material and large corrosion fractures due incomplete condensation of the amalgam.

Horowitz, B. A., Klein, A. I., McDonald, R. E.: Intraoral television micromeasurement of cavity margin deterioration. *J. Dent Res.* 46:700, 1967.

This study was designed to demonstrate a clinical application of the intraoral television microscope and to measure assess the buccal proximal marginal deterioration of the proximo occlusal amalgam restorations in deciduous second molars. The buccal proximal marginal deteriorations of 51 mesio occlusal restorations were measured and evaluated throughout a period of one year. The data indicate that deterioration of the proximal margin went faster than the occlusal margin during the first three months. During the last nine months, occlusal deterioration occurred faster. Microscopic alloy flask was more frequently observed in the proximal area and could account for the greater deterioration in this area during the first three months.

Healey, H. J., Phillips, R. W.: A clinical study of amalgam failures. *J. Prosthetic Dent.* 28:439, 1949.

The authors evaluated 1521 defective amalgam restoration to determine the reasons for these defects. The major reason for failure was recurrent caries which constituted 53.3 percent of the total number of failures observed. Other reasons cited were fractures, dimensional change, and pulp or periodontal involvement.

Bibliography

Anusavice, K.: Quality Evaluation of Dental Restorations. Quintessence Publishing Co. Chicago. IL. 1989

Journal of the American Dental Association: Glass ionomers impact on restorative dentistry. 120; *JADA* Spec Issue: 1990.

Banks, R.: Conservative posterior ceramic restorations: A literature review. *J. Prosthet Dent* 63:619–26, 1990

Chohayeb, A.A., and Rupp, N.W.: Comparison of microleakage of experimental and selected commercially available bonding systems. *Dent Mater* 5:241,1989

Eidelman, E., Fuks, A., and Chosack, A.: A clinical, radiographic, and SEM evaluation of class 2 composite restorations in primary teeth. *OperDent* 14:58, 1989

Eidelman, E., Fuks, A., and Chosack, A.: A clinical, radiographic, and SEM evaluation of class 2 composite restorations in primary teeth. *OperDent* 14:58, 1989

Koenigsberg, S., Fuks, A., and Grajower, R.: The effect of three filling techniques on marginal leakage around class II composite resin restorations in vitro. *Quintessence Int* 20:117, 1989

Pashley, D.H.: Dentin, A dynamic substrate—a review. *Scanning Microsc* 3:161, 1989

Shortall, A., and Asmussen, E: Influence of dentin-bonding agents and a glass-ionomer base on the cervical marginal seal of class II composite restorations. *Scand J Dent Res* 96:590, 1989

Shortall, A. C., and Wilson, H. J.: New materials, bonding treatments and changes in restorative practice. *Br Dent J.* 1988 Jun 25;164(12):396–400.

Block, P. L.: Restorative margins and periodontal health: a new look at an old perspective. *J. Prosthetic Dent.* 1987 Jun;57(6):683–9.

van Dijken, J. W.: A clinical evaluation of anterior conventional, microfiller, and hybrid composite resin fillings. A 6-year follow-up study. *Arta Odontol Scand* 1986 Dec;44(6):357–67.

Robbins, J.: The placement of bases beneath amalgam restorations: review of literature and recommendations for use. J. Am. Dent. Assoc. 113: 910–913 Dec 1986

Grasso, J. E., et al.: Effect of restoration quality on periodontal health. *J. Prosthetic Dent.* 1985 Jan;53(1):14–9.

Welsh, E. L., and Hembree, J. H. Jr.: Microleakage at the gingival wall with four Class V anterior restorative materials. *J. Prosthetic Dent.* 1985 Sep;54(3):370–2.

Hembree, J. H.: Microleakage of composite resin restorations with different cavosurface designs. *J. Prosthetic Dent.* 44:171, 1980.

House, R. C., Patterson, M. W., Pelleu, G. G., McCoy, R. B.: An evaluation of the marginal leakage of spherical high-copper amalgam. *J. Prosthetic Dent.* 39:409, 1978.

Hormati, A. A., Chan, K. C.: Marginal leakage of compacted gold, composite resin, and high-copper amalgam restorations. *J. Prosthetic Dent.* 44:418, 1980.

Torney, D. L., Nourian, Z.: Effect of condensation techniques on marginal adaptation of high-copper amalgam. *J. Prosthetic Dent.* 41:178, 1979.

Klera, S. C., Chan, K. C.: Microleakage and enamel finish. *J. Prosthetic Dent.* 39:414, 1978.

Luscher, B., Lutz, F., Oschenbein, H., Muhlemann, H. R.: Microleakage and marginal adaptation of composite resin restorations. *J. Prosthetic Dent.* 39:409, 1978.

Eames, W. B., MacNamara, J. F.: Eight high-copper amalgam alloys and six conventional alloys compared. *Oper Dent.* 98, 1976.

Waerhaug, J.: Presence of absence of plaque on subgingival restorations in anterior teeth. *J. Prosthetic Dent.* 83:193, 1975.

Viatukas, E. L.: A clinical investigation of composite resin restorations in anterior teeth. *J. Prosthetic Dent.* 27:616, 1972.

Phillips, R. W., Swartz, M. L., Norman, R. D.: Materials for the practicing dentist, St. Louis, 1969, *C. V. Mosby Co.*

Ellis, J. M., Brown, L. R.: Application of an in vitro cariogenic technic to study the development of carious lesions around dental restorations. *J. Dent Res.* 46:403, 1967.

Watchel, L. W., Brown, L. R.: In vitro caries: Factors influencing the shape of the developing lesion. *Arch Oral Biol.* 8:99, 1963.

Nadal, R., Phillips, R. W., Swartz, M. L.: A clinical investigation of the relation of memory to the amalgam restoration. *J. Am. Dent Assoc.* 63:24, 1961.

Operative/

Criterion 2: Contour of Gingival Margin

Claman, L., Kordis, P., and Burch, J.: Periodontal depth vs quality of proximal tooth surface [Abstract]. *J Dent Res* 65:297, 1986

Narvarro, R., Weier, D., Cantor, A., Horney, A., Stoffer, W., Irwin, D., and Morris, H.: Plaque accumulation and reaction of periodontium to crown margin placement [Abstract]. *J Dent Res* 65:297, 1986

Interproximal pocket depth was greater in the presence of caries or overhanging restorations. Nevertheless, even restorations with good margins and no caries were associated with greater pocket depth. The presence of overhang was determined only by radiographs, which may account for the discrepancy between this study and previous reports on gingival health with well-fitting restorations. Supragingival margins of ceramometal crowns were associated with less inflammation than those at or below the gingival margin.

Lang, N., Kiel, R., and Anderhalden, K: Clinical and microbiological effects of subgingival restorations with overhanging or clinically perfect margins. *J Clin Periodontol* 10:563, 1983.

After placement of restorations with overhanging margins, a subgingival flora that closely resembled that of chronic periodontitis was detected. By contrast, after placement of restorations with clinically perfect margins, a microflora characteristic of gingival health or initial gingivitis was observed. These findings emphasize the need for quality control in all facets of restorative dentistry as preventive periodontal procedures.

Jeffcoat, M. K., Howell, T. H.: Alvoelar bone destruction due to overhanging amalgam in periodontal disease. *J. Periodontol.* 51:599, 1981.

Interproximal bone loss around 100 teeth with overhanging amalgam restorations was measured and compared to interproximal bone loss around 100 central lateral teeth without overhanging amalgams. The latter served as controls. Overall, bone loss was found greater around teeth with overhangs. The degree of periodontal disease did not influence the prevalence of this finding, however, with increasing periodontal disease the magnitude of the bone loss increased. Small overhangs, which they defined as occupying less than 20 percent of the interproximal space, did not result in a statistically significant greater bone loss. The authors conclude that small overhangs may be easier to clean thereby reducing plaque accumulation.

Arneberg, P., Silness, J., Norb, H.: Marginal fit and cervical extent of class II amalgam restorations related to periodontal condition: A clinical and roentgenological study of overhang elimination. *J. Periodont Res.* 15:699, 1980.

314 class 2 amalgam restorations were examined by probe and radiographs. Defective restorations were identified and finished. Plaque, gingivitis, and pocket depth were recorded at the initial examination and six months after the finishing procedure to determine the effects of removing these overhangs. The authors did not find significant changes in gingivitis and pocket depth scores after removal of overhangs. They summarize by saying that because this study was not precise in its measuring instruments for the determination of the size of the overhang, it did not disprove the fact that overhanging margins may contribute to periodontal changes. They make a further observation that, based on this study, the placement of an amalgam margin subgingivally may be more critical for tissue reaction than a moderately sized overhang and conclude that restorations should be placed at or above the gingival margin.

Gilmore, N., Sheiham, A.: Overhanging dental restorations and periodontal disease. *J. Periodontol.* 42:8, 1971.

A study was conducted to determine the relationship between overhanging posterior restorations and the severity of periodontal disease in 1763 New Mexicans aged 18 to 44 years. 32 percent of all persons had one or more overhangs and one-third of all posterior with proximal dental restorations had overhangs. Overall, bone loss was greater around overhanging posterior restorations than adjacent surfaces that did not have overhangs. However, there was an insignificant difference in gingivitis scores between teeth with overhangs and those without overhangs. Teeth with overhangs did have .22 mm less bone than controls. The authors concluded that posterior dental restorations with definite overhangs were positively related to severity of periodontal disease in the study population.

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Porter, K. H.: Preventing proximal gingival overhangs in newly condensed amalgams. *J. Prosthet Dent* 1985 Feb;52(2):288.

Kokich, V. G. et al.: Gingival contour and clinical crown length: their effect on the esthetic appearance of maxillary anterior teeth. *Am J. Orthod* 1984 Aug;86(2):89–94.

Lang, N. P. et al.: Clinical and microbiological effects of subgingival restorations with overhanging or clinically perfect margins. *J Clin Periodontol* 1983 Nov;10(6):563–78.

Blank, L. W. et al: The gingival response to well-finished composite resin restorations: a 28-month report. *J Prosthet Dent* 1981 Aug;46(2):157–60.

Garcia, R.: Gingival tissue response to restoration of deficient cervical contours using a glass-ionomer material. A 12-month report. *J Prosthet Dent* 1981 Oct;46(4):393–8.

Dragoo, M. R. and Williams, G. B.: Periodontal tissue reactions to restorative procedures. *Int J. Periodontics Restorative Dent* 1981 Apr;1(1):8–23.

Leon, A.: Amalgam restorations and periodontal disease. *British Dent J.* 140:377, 1976.

Sotres, L. S. Hutsen, G. V., Gilmore, H. W.: A histologic study of gingival tissue response to amalgam, silicate, and resin restorations. *J. Periodontol.* 40:543, 1969.

Bjorn, A., Bjorn, H., Grkovic, B.: Marginal fit of restorations and its relation to periodontal bone level—Part I—metal fillings. *Odontol Revy.* 20:311, 1969.

Alexander, A. G.: Periodontal aspects of conservative dentistry. *British Dent J.* 125:111, 1968.

Trott, J. B., Sherkat, A.: Effect of class II amalgam restorations on health of gingiva: A clinical survey. *J. Can Dent Assoc.* 30:766, 1964.

Zander, H. A.: Effect of silicate cement and amalgam on the gingiva. *J. Am. Dent Assoc.* 55:11, 1957.

Waerhaug, J.: Effect of rough surfaces upon gingival tissue. *J. Dent Res.* 35:323, 1956.

Thomas, B.O.A.: Relationship of operative procedures to the health of the periodontal tissues. *J. Am. Dent Assoc.* 39:522, 1949.

Operative/

Criterion 3: Contact Areas

Jernberg, G. R., Babdash, M. B., and Keenan, K.: Relationship between proximal tooth open contacts and periodontal disease. *J Periodontol* 54:529, 1983.

A retrospective study of periodontal reaction to open contacts involved 104 adults with open contacts on one side and closed contacts on the contralateral teeth. The probing depth and attachment loss was slightly greater (0.5 mm) for teeth with open contacts in spite of less plaque. Food impaction was suggested as an explanation.

Hancock, E. B., Mayo, C. V. Schwab, R. R., Wirthlin, M. R.: Influence of interdental contacts on periodontal status. *J. Periodontol.* 51:445, 1980.

A group of 40 healthy, young adults male naval recruits were examined and scored for gingival inflammation, plaque, food impaction, pocket depth, carious lesions, calculus, restorations and overhangs. The finding showed widespread gingival inflammation with moderate to severe inflammation seen in more than 80 percent of the areas examined. The authors found a significant relationship between food impaction and periodontal status. There was no quantitative information on the relationship of overhanging restorations with contacts or with periodontal status.

O'Leary, T. J., Badel, M. C. Bloomer, R. S.: Intercuspal contact and marginal ridge relationships in periodontally healthy young males classified as to orthodontic status. *J. Periodontol.* 46:6, 1975.

A total of 124 male dental students were evaluated for proximal contacts and marginal ridge relationships in the maxillary left quadrant. Only students with optimal periodontal and gingival health were included in the study. The majority of teeth did not have satisfactory proximal contacts on both mesial and distal aspects. Anterior teeth had the lowest number of satisfactory contacts and bicuspids had the greatest number of acceptable contacts. The implication is that open contact areas are not a factor in the maintenance of periodontal health.

Geiger, A. M., Wasserman, B. H., Turgeon, L. R.: Relationship of occlusion and periodontal disease. Part VIII—Relationship of crowding and spacing to periodontal destruction and gingival inflammation. *J. Periodontol.* 45:43, 1974.

Detailed examinations of occlusal, periodontal, and background characteristics were completed on 516 individuals. This article focuses on the relationship of crowding and spacing to periodontal disease. No positive associations were found among crowding, spacing and periodontal destruction and gingival inflammation of all teeth examined.

Larato, D. C.: Relationship of food impaction to interproximal intrabony lesions. *J. Periodontol.* 42:237, 1971.

121 dry adult human skulls were examined to determine the relationship between the interproximal intrabony lesions and food impaction. The author found that the incidence of interproximal intrabony lesions increases with an increase in the age of the skull, that the majority of interproximal intrabony lesions occur in the molar areas, and that only 18 percent of these lesions were associated with factors able to cause food impaction such as open contacts, plunger cusps, abnormal marginal ridge relationships, and improper tooth alignment.

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Long, T. D. and Smith, B. G.: The effect of contact area morphology on operative dental procedures. *J Oral Rehabil* 1988 Nov;15(6):593–8.

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Gould, M.S.E., and Picton, D.C.A.: The relation between irregularities of the teeth and periodontal disease. *British Dent J.* 121:20, 1966.

Sanjana, M. K., et al.: Incidence of localized periodontal disease of interdental papilla in the premolar region and its relation to the dimensions of the contact points concerned. *J. All India Dent Assoc.* 28:201, 1956.

Hirschfeld, I.: Food impaction. *J. Am. Dent Assoc.* 17:1504, 1930.

Operative/

Criterion 4: Occlusion

Crown and Fixed Prosthodontics/

Criterion 10: Occlusion

Helm, S., and Petersen, P.E.: Causal relation between malocclusion and periodontal health. *Acta Odontol Scand* 47:223-8, 1989

A 20-year follow-up study assessed whether persistent traits of morphologic malocclusion imply an increased risk of periodontal disease. Controlled for other factors, periodontal disease was significantly more frequent in the maxillae in connection with crowding, extreme maxillary horizontal overlap, and reverse occlusion. No association was found in the mandible.

Kampe, T. et al.: Three-year longitudinal study of mandibular dysfunction in young adults with intact and restored dentitions. *Acta Odontol Scand* 1987 Feb;45(1):25–30.

Thirteen adolescents with intact dentitions and 16 with restored dentitions were re-examined after 3 years for signs and symptoms of mandibular dysfunction. In accordance with the results of the first examination, a lower prevalence and degree of clinically recorded dysfunction was found at the follow-up study in subjects with

intact teeth than in those with dental restorations. This difference was especially explained by more muscle tenderness recorded in the individuals with restored dentitions than in those with intact teeth. However, the reported symptoms were as rule mild and relatively evenly distributed in the two groups.

Kampe, T. and Hannerz, H.: Differences in occlusion and some functional variables in adolescents with intact and restored dentitions. A comparative study. *Acta Odontol Scand* 1987 Feb;45(1):31–9

A group of 96 individuals 13 to 15 years of age, with intact teeth, was compared with a control group of 129 individuals with dental restorations, with regard to symptoms and functional recordings of the stomatognathic system. Differences between the groups were established, with higher scores in the dentally treated group with regard to the occurrence of headache, distance between the retruded contact position (RCP) and the intercuspal contact position (ICP), lateral slide between RCP and ICP more than or equal to 0.5 mm, and attrition recorded as dentin facets in the lower first molars. The prevalence of different malocclusions was very similar in the groups, and there were practically no sex differences. The findings are not contradictory to the hypothesis that fillings may be related to mandibular dysfunction, but more studies are necessary to explain fully the mechanisms involved.

Polson, A. M., et al.: Trauma and progression of marginal periodontics in squirrel monkeys. III adaptation of interproximal bone to repetitive injury. *J. Periodontol Res.* 11:279, 1976.

This study was undertaken to characterize the changes which occurred to the interproximal bone between adjacent teeth which were being moved alternately mesially and distally. Mandibular second and third bicuspids in ten squirrel monkeys were subjected to alternating periodontal stresses for ten weeks and they became mobile during this period. Histologic examination demonstrated an initial phase of intense resorptive activity associated with coronal alveolar bone. Histometric comparison of this bone with that normal specimens showed that the trauma caused a loss in crestal height and a great overall reduction in the percentage of coronal alveolar bone. There was no loss in connective tissue attachment verifying that traumatic lesions do not produce periodontal pockets. The reason for this is that the traumatic lesion and subsequent resorptive, reparative and adaptive reactions are confined to the subcrestal periodontal tissues.

Svanberg, G.: Influence of trauma from occlusion on the periodontium of dogs with normal or inflamed gingivae. *Odontol Revy.* 25:165, 1974.

The effect of trauma from occlusion or jiggling forces was studied in 18 beagle dogs. 13 dogs had healthy gingivae and five dogs had gingivitis. The data showed that jiggling and traumatizing occlusal forces resulted in one phase of developing tooth hypermobility and a second phase of permanent tooth hypermobility. The phase of developing tooth hypermobility (traumatic phase) was characterized by osteoclastic alveolar bone resorption and gradually increasing width and vascularity of the periodontal ligament space on the pressure side. During the phase of permanent tooth hypermobility (post traumatic phase) no osteoclastics could be seen and the vascularity of the widened periodontal space was normal. The tooth had adapted to the new environment of a traumatic occlusion. The author concludes that trauma from occlusion did not induce inflammation in non-inflammatory gingiva or did not influence the degree or extent of an established gingival inflammation. There was no development of periodontal pockets.

Wentz, F. M., et al.: Experimental occlusal trauma imitating cuspid interferences. *J. Periodontol.* 29:117, 1958.

The effects of jiggling occlusal trauma upon the periodontium was experimentally studied in six monkeys. Crowns with exaggerated occlusions were placed on the maxillary second premolars. The results after six months demonstrated a widening of the periodontal space to more than three times the original width. The authors conclude that the widening of the periodontal space may be considered as a functional adaptation of the tissues due to changes in the functional requirements. No gingivitis or periodontitis was evident at the end of the experiment.

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Pihlstrom, B.L., et al: Association between signs of trauma from occlusion and periodontitis *J. Periodontol* 57:1, 1986

Wise, M. D.: Occlusion and restorative dentistry for the general practitioner. Part 10—Questions, answers and bibliography. *Br Dent J* 1982 Jul 6;153(1):13–22.

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Ramfjord, S.P. and Ash, M.M.: Significance of occlusion in the etiology and treatment of early, moderate and advanced periodontitis. *J. Periodontol* 52:511, 1981.

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Zander, H. A., and Polson, A. M.: Present status of occlusion and occlusal therapy in periodontics. *J. Periodontol.* 48:540, 1977.

Polson, A. M., et al.: Trauma and progression of marginal periodontitis in squirrel monkeys. IV reversibility of bone loss due to trauma alone and trauma superimposed upon periodontitis. *J. Periodont. Res.* 11:290, 1976.

Lindhe, J., and Ericsson, I.: The Influence of trauma from occlusion on reduced but healthy periodontal tissues in dogs. *J. Clin Period.* 3:110, 1976.

Meitner, S. W.: Co-destructive factors of marginal periodontitis and repetitive mechanical injury. *J. Dent Res.* special issue, C, C-78, C-85, 1975.

Svanberg, G., and Lindhe, J.: Vascular reactions in the periodontal ligament incident to trauma from occlusion. *J. Clin Periodont.* 1:58, 1974.

Glickman, I., and Smulow, J.: The combined effects of inflammation and trauma from occlusion in periodontitis. *Int Dent J.* 19:393, 1969.

Stahl, S. S.: The responses of the periodontium to combined gingival inflammation and occluso-functional stresses in four human surgical specimens. *Periodont.* 6:14, 1968.

Bhaskar, S., and Orban, B.: Experimental occlusal trauma. *J. Periodont.* 26:270, 1955.

Waerhaug, J.: Pathogenesis of pocket formation in traumatic occlusion. *J. Periodont.* 26:107, 1955.

Operative

Criterion 5: Surface

Ratanapridakul, K., Leinfelder, K.F., and Thomas, J.: Effect of finishing on the in vivo wear rate of a posterior composite resin. *J Am Dent Assoc* 118:333, 1989

A study was conducted to determine the influence of finishing on posterior composite resin wear rates. It was found that wear resistance was significantly higher for unfinished posterior composite resins compared with those receiving a conventional finish. The authors suggested that use of a series of diamond instruments with decreasing particle size may be in order. This has been described by *Lutz* and others in previous years.

Serio, F.G., Strassler, H.E., Litkowski, L.J., Moffitt, W.C., and Krupa, C.M.: The effect of polishing pastes on composite resin surfaces. *J Periodontol* 59:837–40, 1988

Scanning electron microscopic evaluation indicated that use of polishing pastes roughened the surface of composite resin restorations.

Bauer, J.G. A study of procedures for burnishing amalgam restorations. *J Prosthet Dent* 57:669, 1987

Eide, R., Tveit, A.B.: A comparison of different techniques for finishing and polishing amalgam. *Acta Odontol Scand* 45:147, 1987

Geiger, E, Reller, U., and Lutz, E: Burnishing, finishing and polishing amalgam restoration [Abstract]. *J Dent Res* 66:329, 1987

Ulusoy, N., Aydin, A.K., and Ulusoy, M.: Evaluation of finishing tehniques for assessing surface roughness of amalgam restorations. *J Prosthet Dent* 57:286, 1987

Neumeyer, S.: Work simplification in carving, burnishing, and finishing of amalgam restorations. *Quintessence Int* 17:209, 1986

In the five studies above burnishing and polishing were again reported to help improve marginal integrity. Amalgams burnished before and after carving showed improvement compared with carved, unburnished restorations.

Ehrnford, L.: Surface characteristics of composite resins comprising a porous reinforcing filler. An in vivo study. *Acta Odontol Scand* 1984 Feb; 42(1):59–64

The surface of composite restorations with filler particles comprising an ultrafine sintered glassfiber network were examined in vivo. The effect of different finishing methods and clinical wear was studied with SEM on replicas. Smooth and lustrous buccal surfaces were obtained with finishing discs. On occlusal surfaces a microfine finishing diamond gave a good surface finish. After wear (greater than 7 months) surface smoothness was favored by a close packing of the filler particles. The smoothest surfaces appeared when, in addition, the density of the sintered network was high.

Simonsen, R. J., and Stallard, R. E.: Surface characteristics of composite restorations. *J. Dent Res*. 55:B140, 1976.

The purpose of this study was to evaluate the effectiveness of an outer sealant layer in producing long term clinical improvement in surface characteristics on class 5 composite restorations. The experimental group was polished and sealed. The control group was polished to clinically smooth surface. The mechanically polished restorations revealed a rough surface under electron microscope analysis whereas the sealed restorations retained a gloss up to three months. A direct correlation was drawn between surface roughness, plaque scores, and gingivitis scores indicating that the use of a sealant layer on class 5 restorations was beneficial.

Waerhaug, J.: Presence or absence of plaque on subgingival restorations. *Scand J. Dent Res*. 83:193, 1975.

108 restorations placed below the gingival margin were stained and examined for the presence or absence of subgingival plaque. 99 of the 108 restorations were covered with plaque. The examples shown in this study demonstrated plaque on the restoration only and not on the tooth. The author concludes that rough surfaces or inadequate marginal adaptation are likely to facilitate a more rapid adherence of bacteria to the restoration than to the smooth tooth surface.

Weitman, R. J., and Eames, W. B.: Plaque accumulation on composite surfaces after various finishing procedures. *J. Am. Dent Assoc.* 91:101, 1975.

This study was undertaken to evaluate the effectiveness of four composite finishing techniques in producing a plaque resistant surface. After 24 hours, most composite surfaces were coated with plaque regardless of the technique used. Control teeth did not have a comparable accumulation until 72 hours. The author postulates the reason for the roughness are filler particles that are irregularly shaped and project from the surface of the composite. Also, small bubbles are scattered throughout. The authors conclude the article by saying that "the surface characteristics of the composite restorations are such that they are incapable of being properly finished."

Sotres, L. S., et al.: A histological study of gingival tissue response to amalgam, silicate, and resin restorations. *J. Periodont.* 40:543, 1969.

Class 5 restorations with cervical margins placed under the free gingiva were made on the labial surfaces of canine teeth in 40 mongrel dogs for the purpose of evaluating the gingival histologic response. Amalgam, silicate, and resin, both polished and unpolished were used to test restorations. The authors demonstrated that rough, unfinished restorations caused the most inflammation. Finished restorations caused some increase of inflammation over control sites. Statistics were not provided.

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Murrey, A., and Watkins, T.: Polishing of amalgams at 30 min. compared to 24 hours. *J Dent Res* 64:180, 1985 (Abstr No. 49).

Yarjanian, D., and Klausner, L.: A quantitative comparison of four amalgam polishing techniques. *J Dent Res* 64:180, 1985 (Abstr No. 51).

McLean, J. W.: Aesthetics in restorative dentistry: the challenge for the future. *Br Dent J 1980* Dec. 16;149(12):368–74.

Waerhaug, J.: Temporary restorations: advantages and disadvantages. *Dent Clin North Am* 1980 Apr;24(2):305–16.

Caputo, A. A.: Biological implications of dental materials. *Dent Clin. North Am.* 24:331, 1980.

Bassiouny, M. A. and Grant, A. A.: The surface finish of a visible light-cured composite resin. *J. Prosthetic Dent.* 44:175, 1980.

Rajstein, J., and Tal, M.: A study of the contour and external surface of class V composite resin fillings. *J. Oral Rehabil.* 6:21, 1979.

Liatukas, E. L.: A clinical investigation of composite resin restorations in anterior teeth. *J. Prosthetic Dent.* 27:616, 1972.

Waerhaug, J., and Zander, H.: Reaction of gingival tissues to self-curing restorations. *J. Am. Dent Assoc.* 54:760, 1957.

Waerhaug, J.: Effect of rough surfaces upon gingival tissue. *J. Dent Res.* 35:323, 1956.

Crown and Fixed Prosthodontics/

Criterion 6: Marginal Integrity

Freilich, M., et al.: The Effects of Resin-Bonded and Conventional Fixed Partial Dentures on the Periodontium: restoration type evaluated. *J. Am. Dent. Assoc.* 121:265–269, 1990

The purpose of this study was to compare the long-term and short-term periodontal response to three different modalities of fixed prosthodontic tooth replacement. Posterior proximal sites adjacent to abutment teeth supporting etched metal and two designs of conventional fixed partial dentures (FPDs) were assessed 6 months to 5 years after insertion. For the long-term observation, the etched metal resin-bonded FPDs had significantly greater plaque scores than both of the conventional designs. The resin-bonded FPD group had statistically, but not clinically, significant increased probing depths than the supragingival FPD group. In spite of the increased levels of supragingival plaque associated with the etched metal FPD, this type of fixed prosthesis was no more injurious to the periodontium than the subgingival conventional FPD designs.

Abbate, M.F, Tjan, A.H., and Fox, W.M.: Comparison of the marginal fit of various ceramic crown systems. *J Prosthet Dent* 61:527–31, 1989

This study involved metal ceramic crowns with a porcelain facial margin, metal ceramic crowns with metal margins, Cerestore restorations, and Dicor restorations. Evaluations were made with the use of a video-enhanced microscope and a digital micrometer. The cast glass ceramic crowns had the greatest mean discrepancy and extrusion molded crowns the least; however, the differences were not significant. All of the systems produced crowns with acceptable margins, and mean openings ranged from 56 to 81μm.

Chan, C., Haraszthy, G., Geis-Gerstorfer, J., Weber, H., and Huettemann, H.: Scanning electron microscopic studies of the marginal fit of three esthetic crowns. *Quintessence Int* 20:189-93, 1989

Chan et al. used SEM evaluation to study the marginal adaptation of Cerestore metal ceramic crowns with metal margins and metal ceramic crowns with porcelain facial margins. A wide discrepancy in individual marginal openings was found (10 to 200 μm). The mean opening for the three materials was 65, 75, and 95 μm respectively for the metal, ceramic, and Cerestore margins.

Flores-de-Jacoby, L., Zafiropoulos, G.G., Ciancio, S: The effect of crown margin location on plaque and periodontal health. *Int J Periodont Rest Dent* 9:197–205, 1989

A study on the effect of placement of crown margins supragingivally, at the gingival margin, or subgingivally on plaque retention and periodontal health at 6 to 8 weeks and 1-year after treatment was reported. As with previous reports, an increase in inflammation was associated with subgingival margin placement. Plaement of the crown margin at the gingival margin also demonstrated greater plaque retention and gingival inflammation requiring more diligent oral hygiene endeavors on the part of the patient.

Morris, H.F.: Veterans Administration Cooperative Studies Project No. 147. Part VIII: plaque accumulation on metal ceramic restorations cast from noble and nickel-based alloys. A five-year report. *J Prosthet Dent* 51:543-9, 1989

A clinical study evaluated alloys used in the restoration of 800 teeth and observed for over a period of 3 years. No differences in plaque accumulation were observed between an AuPd alloy (Olympia, J.F. Jelenko, Armonk, N.Y.) and four alternative alloys (W-1, Williams Gold Refining Co., Buffalo, N.Y.; Ceramalloy II, Johnson & Johnson Dental Division: Microbond NP-2, Austenal Dental, Inc., Chicago, Ill.; and Ticon, Albany, N.Y.). The comparisons were made with an unrestored tooth that served as a control. Significantly more plaque was found on the unrestored teeth than on any of the restorations.

Sorensen, J.A.: A rationale for comparison of plaque-retaining properties of crown systems. *J Prosthet Dent* 62:264-8, 1989

A review of the plaque-retaining properties of crowns as related to surface roughness, marginal fit, and contour was published.

Wohlwend, A., Strub, J.R., and Sharer, P.: Metal ceramic and all-porcelain restorations: current considerations. *Int J Prosthodont* 2:13–26, 1989

A complete review of different ceramic systems in regard to esthetics, marginal adaptation, and fabrication techniques was conducted. Various methods of developing a porcelain margin for metal ceramic crowns were clearly presented. Evaluations were made of the marginal adaptations of metal ceramic, pleated foil, cast glass ceramic, and high-strength aluminous core restorations. This circumspect review clearly indicated that there is no single restoration that meets all needs for a ceramic restoration, but offered helpful suggestions for obtaining the best result from a variety of materials.

Strub, J.R., Stiffler, S., and Scharer, P.: Causes of failure following oral rehabilitation: Biological versus Technical factors. *Quintessence Int* 19:215–22 March 1988.

This long term study provides documented evidence of the high success rate associated with high quality periodontal and prosthodontic techniques combined with home care.

Bruggers, K.J., and Bruggers, H.: Internal venting of castings to improve marginal seal and retention of castings. *J Prosthet Dent* 58:270–73, September 1987.

This study offers documented evidence that internal venting significantly improves the marginal integrity of cast restorations without compromising retention.

Movsesian, G., Navarro, R., Stoffer, W. et al. VA CSP #147: Correlation of margin integrity with periotron readings and gingival index [Abstract]. *J Dent Res* 66:283, 1987

Lariscy, L., Caffesse, R., Cantor, A., et al. VA CSP #147: Comparison of gingival index and plaque index scores with use of alternative alloys [Abstract]. *J Dent Res* 66:283, 1987

Kerry, G., Caffesse, R., Cantor, A., et al. VA CSP #147: Comparison of pocket depth and loss of attachment with use of alternative alloys [Abstract]. *J Dent Res* 66:283, 1987

Studies relating to marginal integrity of gold alloy restorations and four alternative alloy systems revealed no clinically significant difference in plaque retention, gingival index, pocket depth, or attachment loss among the materials as long as the marginal adaptation was favorable.

Pack, A.R.C., and Coxhead, L.J.: Prevalence of overhangs and associated periodontal status in New Zealand patients [Abstract]. *J Dent Res* 66:825, 1987

van Dijken, J.W.V., Sjostrom, S., and Wing, K.: The effect of different types of composite resin fillings on marginal gingiva. *J Clin Periodontol* 14:185, 1987

Chen, J., Burch, J., Beck, F., and Horton, J.: Periodontal attachment loss associated with proximal tooth restorations. *J Prosthet Dent* 57:416, 1987

Eid, M.: Relationships between overhanging amalgam restorations and periodontal disease. *Quintessence Int* 18:775, 1987

Orkin, D., Reddy, J., and Bradshaw, D.: The relationship of the position of crown margins to gingival health. *J Prosthet Dent* 57:421, 1987

Typically, the adverse periodontal reaction to restorations placed near or within the gingival sulcus relates to plaque retention on less-than-optimal marginal adaptation or to porosity of the material. This concept has been reinforced by these studies. One of these studies also related the adverse effect of an overhanging restoration extending to the adjacent tooth pack. Another study analyzed the relation of the position of the crown margin to gingival health, plaque index, and posttreatment gingival recession in 423 patients. (Orkin) Although no information was given about the marginal fit of the crown, the data comparing the status of 68 supragingival margins to 355 subgingival (intracrevicular) margins revealed significantly greater ($p < .001$) plaque retention, bleeding on probing, and gingival recession for the intracrevicular margins. Gingival health associated with crowns having supragingival margins did not differ from that of contralateral health without crowns.

Romanelli, J. H.: Periodontal considerations in tooth preparation for crowns and bridges. *Dent Clin North Am.* 1980 Apr;24(2):271–84.

Correct tooth preparation and adequate reconstruction of the anatomy of the crown are essential to the maintenance and preservation of a healthy periodontium. Adequate tooth preparation requires careful attention to many details and clear knowledge of the features of the finished product. The anatomic reconstruction of the crown with a perfect marginal adaptation will provide an adequate environment for maintaining the health of surrounding periodontal tissues.

Janenko, O., and Smales, R. J.: Anterior crowns and gingival health. *Aust Dent J.* 24:225, 1979.

101 aluminous porcelain jacket crowns and 88 porcelain fused to metal crowns were examined for the purpose of comparing the status of gingival health to several parameters of crowns. Less plaque was seen on the crowns than on control teeth due to the generally high polish of these crowns, but these crowns had significantly more gingivitis. The porcelain jacket crowns had a poorer marginal fit, more overhanging margins, and rougher surface texture at the margin than did the porcelain fused to gold crowns. Gingivitis correlated well with subgingival crown margins, overhanging crown margins, and rough surface texture of crowns. A weaker correlation was found between gingivitis and the marginal fit.

Bjorn, A., et al.: Marginal fit of restorations and its relation to periodontal bone level Part II—crowns. *Odontal Revy*. 21:337, 1970.

This study evaluated the effect of defective margins on the periodontal bone level. 83 percent of the gold crowns and 74 percent of the porcelain crowns were deemed marginally defective. Of this, 68 percent of the defects in gold crowns were equal or greater than .2mm and 57 percent of the defects in porcelain crowns were equal or greater than .2mm. These defects of .2mm or greater were statistically significantly related to periodontal bone loss. The authors conclude by stating that "One might think that an excess or deficiency of material amounting to .2mm still means a fairly good fit. However, for plaque bacteria a .2mm shelf means quite a space for living. In fact, the data reported show that marginal defects are related to periodontal bone destruction."

Silness, J.: Periodontal conditions in patients treated with dental bridges III—The relationship between the location of the crown margin and the periodontal condition. *J. Perdont. Res*. 5:225, 1970.

The periodontal condition of 385 lingual abutment areas with varying locations of the retainer margins were compared with that of 385 contralateral tooth surfaces that were caries free and devoid of fillings. A supragingival position of retainers demonstrated no difference with controls in terms of gingival health and pocket depth. Margins subgingivally placed had a significant increase in gingivitis and pocket depth. The author concludes by saying "It is clear that the cervical junction between the artificial tooth, the luting material and the tooth is the weak link, since it has been shown that bacteria as well degenerate tissue tend to aggregate in this region. When the cervical margins of the crown are located subgingivally, the harmful effects of the soft debris accumulation cannot be obviated because the junctional region is inaccessible to cleansing."

Karlson, K.: Gingival reactions to dental restorations. *Acta Odontal Scand*. 28:895, 1970.

A histological study of the effect of crown margins was done on two dogs and three monkeys. Subgingival and supragingival margins were evaluated. Gingival inflammation was an almost constant finding in subgingival restorations as contrasted with the favorable response in supragingival cases. Furthermore, the gingival condition seems to be closely related to the marginal fit. Restorations placed subgingivally with marginal inaccuracies had a more intense inflammatory response than those subgingival restorations that had well fitting margins.

Christensen, G. J.: Marginal fit of gold inlay castings. *J. Prosthetic Dent.* 16:297, 1966.

The purposes of this study were (1) to measure microscopically the marginal opening termed clinically acceptable by ten experienced restorative dentists and (2) to determine the ability of these ten operators to evaluate the marginal adaptation of visually accessible and visually inaccessible gold inlay margins by explorer. Ten extracted bicuspids were mounted and inlays made for each of them. The ten experienced dentists evaluated the margins of the occlusal, gingival, and proximal surfaces. The dentists were able to evaluate the accessible margins; occlusal and proximal, but were not able to evaluate consistently the gingival margins, which were visually inaccessible.

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Silness, J.: Fixed prosthodontics and periodontal health. *Dent Clin North Am.* 24:317, 1980.

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Glyn Jones, J. C.: The success rate of anterior crowns. *British Dent J.* 132:399, 1972.

Bergman, B., et al.: Periodontal and Prosthetic conditions in patients treated with removable partial dentures and artificial crowns—A longitudinal two year study. *Acta Odontol Scand.* 29:621, 1971.

Silness, J.: Periodontal conditions in patients treated with dental bridges. *J. Periodontal. Res.* 5:60, 1970.

Silness, J.: Periodontal conditions in patients treated with dental bridges—II. the influence of full and partial crowns on plaque accumulation development of gingivitis and pocket formation. *J. Periodont Res.* 5:219, 1970.

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Waerhaug, J.: Effect of zinc phosphate cement fillings on gingival tissues. *J. Periodontol.* 27:284, 1956.

Crown and Fixed Prosthodontics/

Criterion 7: Gingival Contour

Goodaire, C.J.: Gingival esthetics *J. Prosthetic Dent:* 64:1–12, 1990

Achieving the most desirable gingival appearance enhances the esthetic result achieved with fixed prosthodontic restorations and is most often realized when gingival health is optimized before treatment and gingival trauma is minimized during treatment. Methods of optimizing gingival appearance by avoiding soft tissue contact are discussed as are factors considered important to maintaining good gingival appearance when subgingival margins are necessary.

Sackett, B. P. and Gildenhuys, R. R.: The effect of axial crown overcontour on adolescents. *J. Periodontol.* 47:320, 1976.

This study was conducted to learn if axial crown overcontour does have an influence on the state of health of the gingival unit. Processed acrylic overcontoured acrylic facings were cemented to the facial surface of 42 teeth. The contralateral teeth serves as controls. Of these 42 teeth, 27 showed clinical signs of gingival inflammation and alteration of the normal soft tissue architecture after a period of 42 to 49 days. 23 teeth showed greater production of gingival sulcular fluid as compared to control sites. The author concludes that "alteration of normal crown form by overcontouring the buccal axial third of a tooth may be a factor which predisposes the subjacent gingival tissues to inflammatory disease."

Parkinson, C. F.: Excessive crown contours facilitate endemic plaque niches. *J. Prosthetic Dent.* 35:424, 1976.

The purpose of this study was to compare crowns with contralateral natural teeth in terms of facial—lingual width and plaque indices. The results showed that crowns are wider than natural teeth with porcelain fused to metal wider than complete metal crowns and that crowns have a significantly higher plaque indices than natural teeth. The author concludes by stating that although other factors may promote plaque retention, the creation of artificial crown contours that are greater than natural teeth must be considered "another parameter promoting endemic plaque niches."

Perel, M. L.: Axial crown contours. *J. Prosthetic Dent.* 25:642, 1971.

The relationship between axial tooth contours and the surrounding marginal gingiva was studied on six mongrel dogs observed at intervals within a six week period. Procedures producing undercontours and overcontours on facial and lingual surfaces were performed. The contouring extended to .5mm of the gingiva. Clinical and microscopic observations were made respect to the marginal gingiva and cervicular areas. The finding disclosed that (1) axial tooth surface undercontouring did not produce any significant changes in the health of the gingiva, and (2) overcontouring produced inflammatory and hyperplastic changes in the marginal gingiva. Associated with overcontouring was an increase in plaque accumulation.

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Hazen, S. P., and Osborne, J. W.: Relationship of operative dentistry to periodontal health. *Dent Clin North Am.* 11:245, 1967.

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Crown and Fixed Prosthodontics/ Criterion 8: Embrasures

Hirshberg, S. M.: The relationship of oral hygiene to embrasure and pontic design—A preliminary study. *J. Prosthetic Dent.* 27:26, 1972.

One hundred embrasures in six patients were studied over a three year period. The key variable was the height of the embrasure. The conclusions were arrived at as a result of clinical observations and soft tissues biopsies. There were not statistical inferences made. The author concludes that oral hygiene is the overwhelming influence in determining the health of the tissue and that oral hygiene obscured differences that might be produced by varying the embrasure height. Poor oral hygiene reduced the height of the embrasure by creating inflammation. In all patients there was a slight increase in the size of the interdental gingiva after one year of prosthetic insertion. The author states that "the height should be sufficient to accommodate an increase in the size of the gingiva so that, in those patients where oral hygiene is poor, the resulting enlarged tissue will not protrude and trap additional debris."

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Silness, J., and Ohm, E.: Periodontal conditions in patients treated with dental bridges. V effect of splinting adjacent abutment teeth. *J. Periodont. Res.* 9:121, 1974.

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Crown and Fixed Prosthodontics/

Criterion 9: Gingival Contour of Pontic

Criterion 10: Occlusion

Croll, B.M.: Emergence Profiles in natural tooth contour. Part II: Clinical Considerations *J Prosthetic Dent* 374–9, 1990

Selection of the straight emergence profile in designing artificial crowns for teeth has been shown to improve the effectiveness of oral hygience near the gingival sulcus. The axial profile of teeth can be viewed as a series of straight lines with curved transitions. Reproduction of these geometric patterns facilitates fabrication of restorations that appear natural.

Strub, J.R., Linter, H., and Marinello, C.P.: Rehabilitation of partially edentulous patients using cantilever bridges: a retrospective study. *Int J Periodont Rest Dent* 9:365–75, 1989

A retrospective study of 96 cantilever FPDs in 80 patients over an observation period of 5 to 8 years revealed a failure rate of 36% of the FPDs. Biologic failure occurred in 23.3% of the FPDs. These included failures due to periodontal problems (4%), endodontics (14.7%), caries (3%), and fractured abutment teeth (1.4%). Technical failure occurred in 12.7% of the FPDs.

Bergman, B. Ericson, G.: Cross-sectional study of the periodontal status of removable partial denture patients. *J Pronthet Dent* 61:208, 1989

Properly designed RPDs combined with adequate patient oral hygiene resulted in minimal adverse periodontal changes over a 3-year observation period in 34 patients. This study stresses the relationship between periodontics and prosthetic dentistry and the mutual pursuit of excellence in patient care.

Francois, M.: [Gingival reaction to pontic elements] *Rev Belge Med Dent* 1981 Nov;36(6):270–6.

Factors affecting gingival response to pontics are the design, the material used and its roughness and the pressure exerted on the ridge. With a triangular ridge and a large available space, gingival health is promoted by ridge-lap pontics, (with large gingival and lingual embrasures) contacting the ridge with a glazed porcelain, a highly polished gold surface, and without pressure. With a rounded ridge and a narrow available space, modified-saddle pontics are used and the bucco-lingual width is reduced.

Stein, R. S.: Pontic-Residual ridge relationship: A research report. *J. Am. Dent Assoc.* 91:613, 1975.

The author undertook a large and lengthy study to analyze the effect of pontics on the tissue. The results come from histologic samples and clinical evaluation. The major finding of this study is that the pontic design is the foremost factor in obtaining inflammatory-free pontic ridge relationships. The author states that "the ideal design was shown to be a modified ridge lap in the posterior and a lap facing in the anterior region with pinpoint contact on the facial contiguous slope of the residual ridge. The ideal design should include surface smoothness and a fine finish." He also notes that the bullet design is inappropriate because it is both unesthetic and it fosters food stasis because of the exaggerated embrasure space inherent in its design. Finally, he states that the sanitary pontic is the best design for posterior regions if the esthetics permit.

Hirshberg, S. M.: The relationship of oral hygiene to embrasure and pontic design—a preliminary study. *J. Prosthetic Dent*. 27:26, 1972.

42 pontics were studied in six patients over a three year period. The results were determined from clinical observation and soft tissue biopsy. There are no statistical inferences made. The author concludes that ridgelap pontics are less desirable than spheroid or modified sheroid pontics (the modified, spheroid pontics is similar in design to the modified ridge lap pontic noted in previous annotation) in maintaining tissue health. Changing the ridgelap pontic to a modified spheroid pontic by removing the lingual ridgelap alleviated inflammation.

Podshadley, A. G.: Gingival response to pontics. *J. Prosthetic Dent*. 19:51, 1968.

Eighteen pontics were placed in contact with the gingival tissues of nine healthy individuals. The materials for the pontics were glazed porcelain, polished porcelain, gold, and acrylic. Clinically, the tissue contacting only one pontic was noted to be mildly inflamed. Histologically, 17 of the 18 specimens showed microscopic differences when compared to normal control tissues. The majority showed only mild cellular changes. The author concludes that all pontic materials were well tolerated by the tissues but that all pontic materials were well tolerated by the tissues but that all pontics produce some change when they were in contact with the gingival tissue for six months.

Cavazos, E.: Tissue response to fixed partial denture pontics. *J. Prosthetic Dent*. 20:143, 1968.

279 pontics were evaluated as to their impact on tissue response. Minimal contact of the tissue produced no change whereas contact due to scraping the cast more than .25mm caused unfavorable tissue change. Gold pontics of ovoid shape produced unfavorable tissue change under only 20 percent of the pontics with minimal relief whereas gold pontics with ridgelaps produced unfavorable tissue change in 75 percent of the pontics with minimal relief.

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Endodontics

Criterion 11: Apical Fill (Obturation)

Narracott, P.: An in vitro comparison of the single cone and lateral condensation techniques using friction-fitted and solvent dip-fitted primary gutta-percha cones. *Aust Dent J* 1989 Feb;34(1):49–51.

Extracted teeth, root-filled by single cone and lateral condensation techniques, using friction fitted and solvent (chloroform and eucalyptol) dip-fitted primary gutta-percha cones, were compared with respect to apical sealing as measured by length of dye penetration and frequency of no dye penetration. Overall, the single cone techniques were significantly more effective than lateral condensation techniques regarding length of dye penetration. The single cone techniques were not significantly different from the lateral condensation technique which employed chloroform dip-fitted primary gutta-percha cones regarding length of dye penetration. The single cone and lateral condensation techniques which utilized chloroform dip-fitted cones ranked first and second with respect to frequency of no dye penetration.

Halse, A., and Molven, O.: Overextended gutta–percha and kloroperka N–Ö root canal fillings: Radiographic findings after 10–17 years *Acta Odontol Scand* 45:171–177 June 1987

At one time apical overfilling was considered to be a classical indication for apical surgery. This long term study clearly contradicts this practice. The presence or absence of apical radiolucency is an important factor relative to prognosis.

Russin, T. P., et al.: Apical seals obtained with laterally condensed, chloroform softened gutta-percha and laterally condensed gutta-percha and Grossman's sealer. *J. Endod.*, vol. 6., no. 8, Aug. 1980.

Results of this study showed a pattern of greater periapical leakage in root canals obturated with gutta-percha softened in chloroform (P .001), than in those obturated with gutta-percha and Grossman's sealer.

Barkakow, F. H., et al.: An evaluation of 566 cases of root canal therapy in general dental practice. 2. Post operative observations. *J. Endodontic*, vol. 6., no. 3, March, 1980.

The clinical and radiological success of endodontic treatment on 566 teeth was assessed. A successful result was one in which the patient was without symptoms, and the tooth showed no tenderness to percussion or abnormalities according to radiographs. In most successful cases the root canal filling was at the apex as shown by radiographs. When the filling was short regardless of the distance to the apex, success was less substantial. This is in accordance with the findings of Grossman and others, but, in contrast to the findings of others (Seltzer & Bender) who have found that overfilling produces the poorest results.

Ross, I. F.: Fracture susceptibility of endodontically treated teeth. *J. Endod.*, vol. 6., no. 5, May 1980.

102 patients with a total of 200 teeth that were treated endodontically were examined to determine how many teeth had fractured 5 years or more after treatment. 134 teeth had endodontic therapy only, whereas 86 had an internal supporting device inserted during endodontic therapy. All teeth were functioning favorably at the time of the study. There was no evidence of fracture of any tooth at least 5 years after endodontic therapy, whether an internal supporting device had been used.

Crump, M. C.: Endodontic failure. *Dent Clin North Am.* 23:4, 617:635, 1979.

Crump reviews the major reasons for failure in endodontic therapy. They are incomplete preparation and obturation, perforation, overfilled (he indicates however, that overfill is best avoided but does not regularly result in failure) canals.

Kuttler, Y.: Analysis and comparison of root canal filling techniques. *Oral Surg.* 153:9, 1979.

The author concludes that the great majority of the root canal filling achieved with all three groups of techniques are underfillings or overfillings and are thus unacceptable. Clinical success is not enough. The roentgenographic absence of "metaendodontic" alterations is also required. His four postulates for the adequate filling of root canal are: (1) the filling must reach as close as possible to the CDC junction in the first two classes of canals (2) a complete seal must be achieved at the terminal portion of the filling (3) the apical end of the filling must carry a biologic stimulus for cemento-blasts and or fibroblasts (4) the remaining dentinal portion of the canal must be totally filled, thus sealing off all of its tubules. The author argues that most techniques presently in use have great deficiencies (other than his own precision and biologic technique). For this reason he is not surprised at the low percentage of successes obtained by other researchers, ie., Brynolf, Tavano, et.al., Yamaauchi, et. al., Silveira. Only a controlled technique such as the precision and biologic one which fulfills the above postulates, can attain the high degree of success 89.2% he has recorded.

Bergenholtz, G., et al.: Influence of apical overinstrumentation and overfilling on re-treated root canals. *J. Endod.* Vol. 8, No. 10 1979.

This study shows that if the root canal was reamed through the apex and if the root canal filling was overfilled during the treatment procedure a significantly lower frequency of completely regenerate periapical lesions was observed than if these two complications did not occur.

Spangberg, L., et al.: Biologic effects of endodontic antimicrobial agents. *Journal of Endod.* Vol. 5., No. 6, 1979.

Five commonly advocated medicament intracanal dressings were evaluated in vivo and in vitro. A critical analysis of previously published data on these medicaments is made—camphorated paramonochlorophenol, camphorated phenol, formocresol, iodine potassium 2%, and iodine potassium 5%. Iodine potassium 2% proved the most satisfactory choice for the biologically inclined practitioner, both in terms of low tissue irritation and high antimicrobial effect.

Van Hassell, H. J., et al.: Endodontics. *Dent Clin North Am.* 23:4, 1979.

This is a current review of the scope, diagnosis and treatment of endodontic problems.

Kerekes, K., and Tronstap, L.: Long term results of endodontic treatment performed with a standardized technique. *J. Endod.* Vol.5., No. 3, 1979.

The long term results of endodontic treatment according to Ingles' standardized technique performed by undergraduate students in Oslo during 1971 were assessed. An adequate seal was found in 97% of the roots. Results of treatment were judged by these criteria—successful when the radiographic width and contour of the periodontal space were normal or when there was a slight radiolucent zone around an excess of root filling material—failure when a periradicular radiolucency was observed. Canal obturation was recorded as adequate when no space was discernible between filling material and root canal wall and defective when a space could be discerned. Overfilling greater than 1 mm was observed in 3% of the roots. The overall success rate was 91% with no statistically significant difference between anterior and posterior teeth. Roots with periradicular radiolucencies showed better results than roots with radiolucencies (statistically significant). It was concluded that this standardized technique led to an improvement in the technical standard of root canal fillings.

Heiling, B., and Kischinovsky, D.: Factors affecting successful endodontic therapy. *J. Br Endod Soc.* 12:83, 1979.

The purpose of this survey was to show how the quality of root canal fillings affected the success of treatment. A case was considered successful if the tooth was comfortable and if there was radiographic evidence of an eliminated or arrested area of rarefaction a year after treatment.

A total of 127 teeth with 202 roots were examined and evaluated from one to 16 years after nonsurgical endodontic therapy. The canals had been filled with AH26 sealer and gutta-percha points using a lateral condensation technique.

The following criteria were used to determine the quality of the root canal filling: the level of root filling (more than 2 mm from apex, less than 2 mm from apex, flush with the apex, or beyond the apex); and the distinctness of the radiographically visible root canal space apical to the root filling.

Treatment was successful in 81% of the teeth. The success rate ranged from 77% to 92%, depending on the age group; the highest success rate occurred in young patients. Of the 202 treated roots, 59.9% of the root fillings were short of the apex, 23.3% were filled to the radiographic apex of the tooth, and 16.8% showed the root filling through the apical foramen. The highest success rate was observed in those cases where no excess of root filling material was seen radiographically, and there were fewer failures in root canals with fillings less than 2 mm short of the apex. Periapical lesions were also more common in the presence of a radiographically demonstrable unfilled space apical to the root filling. The success rate was higher where there was no evidence of excess root filling material periapically. There was no statistically significant difference between success of vital and necrotic pulps. Teeth that had received a permanent restoration had a higher rate of success than those teeth that were not restored permanently at the time of the completion of the root filling.

Brynolf, I.: A histological and roentgenological study of the periapical region of human upper incisors. *Odontol Revy.* 18 (Supp. 11) 128, 1967.

This study included 96 root filled teeth and concluded that excess filling (overfilling) appears to sustain a chronic inflammation in the periapical area. This study reveals that only 7% of root canals commonly treated are successful.

Allison, D. A., et: The influence of the method of root canal preparation on the quality of apical and coronal obturation. *J. of Endod.* Vol. 5, No. 10., 1979.

Although there are no published data on failures directly related to incomplete coronal seal, the authors believe that canals that leak coronally ultimately may result in an oral-apical communication and therefore have a poorer prognosis. This study indicated that a tight coronal seal could be produced by vertical condensation of warmed gutta-percha. The amount of micro leakage was assessed by autoradiography. The quality of the apical seal was directly related to the depth of spreader penetration. These seals should result in better obturation.

Grossman, L. I.: Endodontic practice, ed. 9. Philadelphia, *Lea & Febiger,* 282, 1978.

Grossman summarizes his concern in the critical area of the obturation of the pulp canal space in order to prevent an exchange of external fluids with the canal space or filling material or both.

Ingle, J. I.: Endodontics. ed. 2. Philadelphia, *Lea & Febiger,* 54:77, 1976.

In the Washington study, Ingle examines endodontic success and failure. Included in the success group were those cases with decided periapical improvement and those cases with constant periapical health. The failure cases are made up of those which initially demonstrated periapical damage and which have not improved, as well as those cases which have deteriorated since treatment. 1229 patients were examined at 2 year recall with a success rate of 91.10% of those treated before 1955 and 94.45% of those treated after 1955. After 1955, improvements in technique were initiated, thus lowering the failure rate from 8.9% to 5.55%. No significant difference in failure rate existed between any teeth in the mouth. The two greatest causes of failure include imperfect instrumentation (9.6%) and incompleted obliteration (58.6%) and account for over ⅔ of all failures in the study. These studies rely on radiographic assessment of the quality of obturation and conclude that poor obturation was a major cause of failure.

Schilder, H.: Filling root canals in three dimensions. *Dent Clin North Am.* 723–744, 1967.

Rothschild, M. B.: A second look at the first principles. An evaluation of some endodontic dogma. *J. Br Endod Soc.* 5:32–39, 1971.

Cohen, S., and Burns, R. C.: Pathways of the pulp, St. Louis. *C. V. Mosby Co.* 134, 1976.

The above consider the importance of the apical seal in attaining clinical endodontic success. Though evidence is presented, this has not been clearly proved. No studies show whether the quality of the seal can be assessed radiographically in patients.

Grahnen, H., and Hansson, L.: The prognosis of pulp and root canal therapy. A clinical and radiographic follow up examination. *Odontol Revy.* 12(2):146–165, 1961.

Engstrom, B., and Lundberg, M.: The correlation between positive culture and the prognosis of root canal therapy after pulpectomy. *Odontol Revy.* 16:193–203, 1965.

Molven, O.: The frequency, technical standard and results of endodontic therapy. *Nor Tannlaegeforen Tid.* 86(4–1):142–147, 1976.

These three studies mentioned above demonstrate a higher frequency of failures in which root filling material has been packed beyond rather than short of the apical foramen.

Ingle, J. I.: Root canal obturation. *JADA.* 53:47–55, 1956.

Incomplete root canal obturation is associated with 75% of all endodontic failures.

Dow, P. R., and Ingle, J. I.: Isotope determination of root canal failure. *Oral Surg.* 8:1100–1104, 1955.

Incomplete root canal fillings are associated with more than half of all endodontic failures. Intentionally poorly obturated canals in vitro permit gross microleakage of isotopes.

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Harris, G. Z. et al.: Apical seal: McSpadden vs lateral condensation. *J. Endod* 1982 Jun;8(6):273–6.

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Leonardo, M. R., et al.: Pulpectomy: Immediate root canal filling with calcium hydroxide. Concept and procedures. *Oral Surg.* 49.5. 441–50, 1980.

Goldman, L. G., et al.: The use of a hydrophilic plastic as a root canal filling material—Delivery system and technique. *Quintess. Int.* 10.2. 101–7, 1979.

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Taintor, J. F., and Ross, P. N.: Opinions and practices of American endodontic diplomats. *Dent J.* 44(7):321–325, 1978.

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Weine, F. S., et al.: Endodontic emergency dilemma: Leave tooth open or keep it closed. *Oral Surg.* 40:531–6, 1975.

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Heling, B., and Tamshe, A.: Evaluation of the success of endodontically treated teeth. *Oral Surg.* 30(5):553–536, 1970.

Seltzer, S., et al.: Endodontic failures—an analysis based on clinical, roentgenographic and histologic findings. *Oral Surg.* 23:517, 1967.

Storms, J. L.: Factors that influence the success of endodontic treatment. *J. Can Dent Assoc.* 35(2):83–97, 1969.

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Removable Prosthodontics Partial Dentures/

Criterion 12: Stability

Criterion 13: Retention

Complete Dentures/

Criterion 18: Stability

Criterion 19: Retention

O'Brien W. J.: Base retention. *Dent Clin North Am*. 123:30, 1980.

Removable partial dentures rely on a number of mechanisms for retention. In the case of precision attachment removable partial dentures the friction between the parts of the attachment is probably the most significant. Also muscular forces involving the cheeks, tongue and lips contribute to retention. The role of saliva in retention of denture bases is discerned in terms of atmospheric pressure, surface tension and viscosity. There is little evidence that atmospheric pressure is a significant factor. Surface tension contributes to retention only if the film of saliva interposed between the denture base and underlying tissue is isolated and does not extend beyond the denture borders. The factors that increase retentive force are (1) close adaptation of the denture base to supporting tissue; (2) high viscosity of saliva; (3) short application of displacement forces; (4) adequate wetting of the denture base material by saliva.

Casey, D. M., and Lauciello, F. R.: A review of the submerged root concept. *J. Prosthetic Dent*. 43:128, 1980.

This concept is presented as an alternative to conventional overdenture techniques and may be an expedient and inexpensive way of preserving alveolar bone for the support (retention and stability) of complete or removable partial dentures.

Lindstrom, R. E., et al.: Physical-chemical aspects of denture retention and stability: A review of the literature. *J. Prosthetic Dent*. 371:5, 1979.

Writings on the significance of film pressure, atmospheric pressure, surface tension, salivary film and salivary viscosity are reviewed and analyzed. The different viewpoints suggest that the physical chemical retention of dentures is a complex phenomenon controlled by multiple factors. A key observation is that these critical factors are more operational as the space between denture and mucosa becomes diminished. A loss of denture retention can thereby be attributed to an increased in the denture-mucosa interspace rather than to changes in the physical-chemical factors of retention.

Wright, C. R.: Evaluation of factors necessary to develop stability in mandibular dentures. *J. Prosthetic Dent*. 16:414, 1969.

The author defines retention as the resistance to vertical or torsional stress, or the resistance of a denture to removal in a direction opposite to that of its insertion.

Wical, K. E., and Brussee, P.: Effects of a calcium and vitamin D supplement on alveolar ridge resorption in immediate denture patients. *J. Prosthetic Dent*. 41:4, 1979.

Supplements of calcium and vitamin D after extraction of teeth were demonstrated to effect loss of alveolar bone 36% less than in controls.

Ellinger, C. W., et al.: Patient response to variations in denture technique. Part III: Five-year subjective evaluation. *J. Prosthetic Dent*. 127:30, 1979.

Interest continues in the economics of the construction of removable dentures. The value of sophisticated procedures continues to be questioned. Two different denture techniques, designated as complex and standard, were evaluated over 5 years. The standard procedure did not include face-bow transfers; teeth were

arranged in tight centric occlusion coincidental with centric relation, with no attempt made to balance the occlusion. After processing, occlusal corrections were made in centric relation only. All further corrections were made intraorally. Data were compiled of the findings of observers following a list of seven specific factors: (1) coincidence of centric relation with centric occlusion, (2) stability of the upper denture, (3) retention of the upper denture, (4) stability of the lower denture, (5) retention of the lower denture, and (7) condition of the tissue supporting the lower denture. Nothing is reported on the patients' own evaluations of the dentures. At the end of the 5-year period, the annual evaluations were statistically tabulated. No significant differences were found between dentures made using the two techniques. Such a study presents numerous dangers, the major one being the implication that detailed procedures may not be necessary. All of the 64 dentures were probably made carefully regardless of which technique was used. We must guard against supporting unwarranted, shortened, or sloppy practice.

Berg, T. Jr.: I-Bar: Myth and countermyth. *Dent Clin North Am.* 65:75, 1979.

The author concludes that the I-bar in itself provides low retentive value compared with other retainers. This is partly owing to minimal tooth engagement and partly to purposeful design. With very short teeth and/or a lack of provision for the guarding planes I-bar retainers may be found lacking in overall retention. The author also reviews advantages and design of RPI dentures including guide planes and proximal plates.

Kawazoe, Y., and Hamada, T.: The role of saliva in retention of maxillary complete dentures. *J. Prosthetic Dent.* 131:6, 1978.

In this study maxillary denture retention was influenced by the salivary volume between the denture base and the mucous membrane. An optimum intervening salivary volume, at which the greatest retention was developed, was also observed.

Tyson, R.: Physical factors in retention of complete upper dentures *J. Prosthetic Dent.* 18:90, 1967.

Tyson concluded that the thickness of the saliva film is important only at the borders or seals.

Craig, R. G., et al.: Physical factors related to denture retention. *J. Prosthetic Dent.* 10:459, 1960.

Craig and others indicated that film pressure was not a factor in retention and identified capillarily as the principal retentive force.

Ostlund, S.: Saliva and denture retention. *J. Prosthetic Dent.* 10:658, 1960.

Clinical data are presented suggesting that the amount, or thickness of saliva film is important.

Stanitz, J.: An analysis of the part played by fluid film in denture retention. *J. Am Dent Assoc.* 37:168, 1948.

Stanitz placed the mechanism of denture retention on a theoretical, quantitative basis by assuming that the interactions in the denture-saliva-palate system were analogous to those in a system comprised of two circular glass plates separated by a thin layer of liquid. One objective in denture treatment according to this model is to maximize the area of the denture tissue interface.

Snyder, F. C., et al.: Effect of reduced atmospheric pressure upon retention of dentures. *J. Am Dent Assoc.* 32.445, 1945.

The authors conducted an in vivo study of atmospheric pressure effects by measuring denture dislodgment forces in patients at sea level and in a decompression chamber.

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Schmidt, W. F. Jr. and Smith, D. E.: A six-year retrospective study of Molloplast-B-lined dentures. Part I: Patient response. *J Prosthet Dent* 1983 Sep;50(3):308–13.

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Niksic, D., et al.: The influence of retention of upper and lower complete dentures on masticatory efficiency. *Acta Stomatol Croat* 1982;16(4):257–65.

Nairn, R. I.: The design of the partial denture framework. 2. Preventing movement of the partial denture base. *J Dent* 1981 Jun;9(2):157–70.

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Ramstad, T., et al.: The reliability of clinical evaluation of some characteristics in complete prosthetics. *J Oral Rehabil* 1980 Jan;7(1):11–9.

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Sheppard, I. M., et al.: Survey of the oral status of complete denture patients. *J. Prosthetic Dent.* 121:6, 1972.

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Blahova, Z., and Neuman, M.: Physical factors in retention of complete dentures. *J. Prosthetic Dent.* 230:5, 1971.

Gesser, H. D. and Castaldi, C. R.: The preparation and evaluation of wetting dentures for adhesion and retention. *J. Prosthetic Dent.* 236:43, 1971.

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Removable Prosthodontics Partial Dentures/

Criterion 14: Occlusion

Complete Dentures/

Criterion 20: Occlusion

Curtis, T. A. et al.: Occlusal considerations for partially or completely edentulous skeletal Class II patients. Part II: Treatment concepts. *J Prosthet Dent* 1988 Sep;60(3):334–42.

Four basic concepts must be considered when developing the prosthetic occlusion for skeletel class II patients: (1) Centric relation must be used as a reference position to relate the mandible to the maxiliae; (2) the posterior denture teeth must be positioned close to their former positions; (3) freedom of movement must be created in eccentric movements; and (4) multiple occlusal contacts must be provided in centric and eccentric positions. We have described a method that incorporates these basic concepts and provides a harmonious occlusal arrangement for both edentulous and partially edentulous class II patients.

Givens, C.D., Armentrout, T., Fields, H. Jr, and Von Fraunhofer, J.A.: Wear of low cost acrylic resin denture teeth [Abstract]. *J Dent Res* 66:217, 1987

Wear evaluation of lower cost monoplane acrylic denture teeth in vitro suggests that they have acceptable wear characteristics compared with widely used denture teeth.

Woda, A., et al.: Non-functional and functional occlusal contacts: A review of the literature. *J. Prosthetic Dent.* 42:335, 1979.

A review of the literature on occlusal contacts emphasizes that (1) contacts in centric occlusion do not correspond to any ideal occlusal diagram; (2) canine protection and group function appear to correspond to two successive states of the evolving dentition under the effect of abrasion; (3) during mastication, tooth contacts occur; (4) during unilateral mastication, food is chewed by working as well as non working contact; (5) centric occlusion is the occlusion most often used during mastication and (6) the published data on occlual contacts during swallowing are largely contradictory.

Goldstein, G. R.: The relationship of canine-protected occlusion to a periodontal index. *J. Prosthetic Dent.* 41:277, 1979.

In a study to determine patterns of disclusion and their relationship to an index of periodontal disease, 14% of the subjects exhibited canine protection, 16% exhibited a pattern of progressive disclusion, 46% exhibited group function, and 24% exhibited a different disclusion on each side. The teeth in mouths having canine-protected occlusions had a significantly lower index of periodontal disease than the teeth in mouths having progressive disclusion or group function. Also, the canines and the molars in the canine-protected group exhibited a lower index of periodontal disease than their counterparts with progressive disclusion or group function.

Parkinson, C. E: Similarities in resorption patterns of maxillary and mandibular ridges. *J. Prosthetic Dent.* 39:598, 1978.

Observations on the directional patterns of bone resorption showed that ridge migration occurs lingually in both jaws. The progressive and irreversible mandibular alveolar resorption rate is greatest in the early stages edentulism and slows with loss of bone, longevity of edentulism and attendant wearing of dentures.

Ortman, H. R.: Complete denture occlusion. *Dent Clin North Am.* 2999:30, 1977.

This extraordinarily comprehensive and well written article reviews and discusses all areas related to achieving positive occlusal results and a positive reaction of bone to occlusal pressure and tension. Differences between the natural and artificial occlusion are discussed and the requirements of complete denture occlusion elucidated: These are (1) stability at centric relation position and in an area forward and lateral to it; (2) balanced occlusal contacts bilaterally; (3) unlocking of cusps mesiodistally to allow for gradual setting of the bases; (4) control of horizontal force by buccolingual cusp height according to residual ridge resistance form; (5) functional lever balance by favorable tooth to ridge crest position; (6) cutting and shearing and incisal clearance during posterior function. Further requirements are suggested for incisal, occlusal and balancing units.

Advantages and disadvantages of various types, materials, and setting of teeth are reviewed and discussed. Achieving a balanced occlusion is reviewed utilizing selective grinding.

Neiburger, E. J.: Flat plane occlusion in the development of man. *J. Prosthetic Dent.* 38:459, 1977.

Comments on the advantages of flat plane occlusion and a review of the development of the dentition in man are presented.

Kelly, E.: Centric relation, centric occlusion and posterior tooth forms and arrangement. *J. Prosthetic Dent.* 37:6, 1977.

Seven objectives are stated as desirable for producing good posterior occlusion in complete dentures. Three widely used occlusal schemes (1) monoplane occlusion (2) cusp to fossae occlusion (3) curved occlusal plane with zero degree teeth are discussed.

Fraser, G. N.: An evaluation of terminal hinge position and neuromuscular position in edentulous patients, Part II., duplicate mandibular dentures. *J. Prosthetic Dent.* 37:12, 1977.

Study of edentulous patients wearing complete dentures was conducted to see if the occlusion was as functional at the neuromuscular position (NMP) as one fabricated at the terminal hinge position (THP). Two mandibular dentures were made, one at each position, with one maxillary denture. Patients had no prior knowledge of the two dentures which were alternately used. It was concluded that the neuromuscular position is clinically acceptable for intercuspation of artificial teeth on complete dentures.

Glaros, A. G., and Rao, S. M.: Effects of Bruxism: A review of the literature. *J. Prosthetic Dent.* 38:149, 1977.

This article reviews the effects of bruxism in six major areas (1) dentition (2) periodontium (3) masticatory muscles (4) TMJ (5) head pain (5) psychological/ behavioral.

Clarke, N. G.: Treatment planning for fixed and removable partial dentures: A periodontal view. *J. Prosthetic Dent.* 36:44, 1976.

The potential injury to the periodontium from fixed and removable partial dentures is reviewed. The major consideration is directed toward the attachment apparatus of abutment teeth and response of these teeth to increased loads. Conclusions are: (1) chronic occlusal trauma of partial denture abutments may be observed in radiographs before other clinical symptoms are noted. (2) evaluation methods can determine when teeth are unsuitable to serve as abutments (3) whenever a potential abutment is tilted so that axial loading is questionable no restoration should be made.

Woelfel, J. B., et al.: 5 year cephalometric study of mandibular ridge resorption with different posterior occlusal forms. Part I. Denture construction and initial comparison. *J. Prosthetic Dent.* 36:602, 1976.

This study investigates the influence of various factors concerned with wearing complete dentures. 52 patients were chosen for this 18 year study and divided into 3 groups. New dentures were made for all. The groups consisted of 0 degree, 20 degree, and 33 degree posterior teeth. They were examined annually and checked for change in tissue contour, denture warpage, tooth chipping and wear, change in occlusion and loss of VDO. The numbers of sore spot adjustments were recorded. Findings show more sore spot adjustments were necessary on dentures with flat teeth and more mandibular ridge shrinkage occurred when these teeth were used. The study would indicate that dental schools should not limit their undergraduate teaching in removable prosthodontics to flat plane occlusion but offer a more varied experience.

Plotnick, I. J. et al.: The effects of variations in the opposing dentition on changes in the partially edentulous mandible. Part I. Bone changes observed in serial radiographs. *J. Prosthetic Dent.* 278:86, 1975.

A clinical study was conducted to determine the effects of variations in the opposing dentition on the mucosa and bone of the mandible and on the movement of abutment teeth. Lower removable partial dentures were constructed for three groups of subjects. The opposing occlusion for one group was a complete upper denture; for another group, an upper removable partial denture; and for the third group, upper natural teeth. A control group of partially edentulous subjects did not wear lower removable partial dentures.

Based upon the method used and the results, the following conclusions were drawn for subjects wearing lower distal-extension removable partial dentures for an 18 month period:

(1) Various magnitudes of force generated by opposing dentitions during normal functions and transmitted to the mandible through distal-extension lower removable partial dentures apparently do not materially affect the bone level of the supporting mandibular residual ridge.

(2) The type of upper dentition opposing a distal-extension lower removable partial denture is related to the amount of destruction of the lower residual ridge, including the amount of bone lost, mucosal changes, and displacement of abutment teeth.

(3) For patients wearing distal-extension lower removable partial dentures, and addition and predominantly mesially directed horizontal component of force is placed upon the abutment teeth.

(4) Since the most significant destructive changes in the lower ridge occur in the complete upper denture group, the fit of the prosthesis apparently was not a determining factor. This conclusion is limited to the fact that only lower removable partial dentures judged to be clinically acceptable by the investigators were used in this study.

(5) The greater the degree of change in the supporting structures for the partial lower denture, the greater the time period over which these changes take place.

Murrell, G. A.: Phonetics, function, and anterior occlusion. *J. Prosthetic Dent.* 23:31, 1974.

The author discusses the use of phonetics in the positioning of anterior teeth on complete dentures to re-establish occlusion and function on anterior teeth. The location of these teeth in the mouth makes them a critical factor in the support of the patient. Normal, atypical and abnormal situations of anterior teeth are described. Methods are suggested for recording the occlusal vertical relation and for providing functional space between opposing anterior teeth in completed dentures.

Sears, V. H.: Experiments in occlusion. *J. Prosthetic Dent.* 2:22, 1952.

Sears published the following axioms for denture occlusion which have served as basic guidelines, they are: (1) the smaller the area of occlusal surface acting on food, the smaller will be the crushing force transmitted to the supporting structures; (2) vertical force applied to an inclined occlusal surface causes non vertical force on the denture base; (3) vertical force applied to an inclined supporting tissue causes non vertical force on the denture base; (4) vertical force applied to a denture base supported by yielding tissue causes the base to teeter when the force is not centered on the base; (5) vertical force applied outside (lateral) to the ridge crest creates tipping forces on the base.

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Nyman, S., and Lindhe, J.: Considerations on the design of occlusion in prosthetic rehabilitation of patients with advanced periodontal disease. *J. Clin Periodontal.* 1:15, 1977.

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Sabet, E. M.: A clinical study on the relationship between the upper and the lower ridges at the correct vertical dimension of occlusion. *Egypt Dent J.* 133:40, 1972.

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Carlsson, G. E., et al.: Changes in height of the alveolar process in edentulous segments. A longitudinal clinical and radiographic study over 5 years of full upper denture patients with residual lower anteriors. *Sven Tanlak Tidskr.* 125:36, 1969.

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Removable Prosthodontics Partial Dentures/

Criterion 15: Extension/ Tissue Adaptation

Complete Dentures/

Criterion 21: Extension

Criterion 23: Tissue Adaptation

Tuominen, R., Ranta, K., and Paunio, I.: Wearing of removable partial dentures in relation to periodontal pockets *J. Oral Rehab* 16:119–126, 1989

Using a representative sample of 5028 dentulous Finnish adults the occurrence of periodontal pockets was studied separately for the maxillae and the mandibles among removable partial denture (RPD) wearers and non-wearers. RPD(s) were worn in 11·2% of the 3444 maxillae with at least four natural teeth remaining, and in 7·7% of the 4706 corresponding mandibles ($P<0·001$). Periodontal pockets were more frequently observed in maxillae than mandibles. Wearing of RPDs highly significantly ($P<0·0001$) increased the odds of having periodontal pockets in general (4 mm or more) as well as the odds of having deeper periodontal pockets (exceeding 6 mm). This phenomenon was observed both in the maxillae and in the mandibles. These results suggest that wearing of RPD is a threat to periodontal tissues and that dentists should take care to frequently recall their patients fitted with RPD(s). During the recall visits more attention should be paid to the periodontal conditions of patients wearing RPD(s).

Sabes, W. R., et al.: Patient response to variations in denture technique Part IV Microscopic response of the oral mucosa. *J. Prosthetic Dentistry*. 45:11, 1981.

The authors compared several morphologic and physiologic responses to two different clinical techniques—a complex and standard one. This report reviews the microscopic changes from the two groups over a 5 year period and found no discernible differences.

Chen, M. S.: Reliability of the fovea palatini for determining the posterior border of the maxillary denture. *J. Prosthetic Dentistry*. 43:133, 1980.

Observations of this observer on 104 patients suggest the fovea palatini are unreliable guides for locating the posterior border of maxillary dentures.

Massler, M.: Geriatric Nutrition: The role of taste and smell in appetite. *J. Prosthetic Dentistry*. 43:246, 1980.

Proper nutrition is essential to the health of the oral tissues, and healthy tissues enhance prosthodontic treatment of the elderly. All dentists should be prepared to offer dietary advice to this population.

Bauman, R.: Minimizing post insertion problems: A procedure for removable partial denture placement. *J. Prosthetic Dentistry*. 42:381, 1979.

The article describes a step by step procedure for dealing with (1) Correction of denture base extensions and pressure spots (2) Establishment of occlusal harmony and (3) Home care instructions.

Benson, D., Spolsky, V. W.: A clinical evaluation of removable partial dentures with I-bar retainers. Part 1. *J. Prosthetic Dentistry*. 41. 3. 246–54, 1979.

A clinical evaluation of 77 removable partial denture patients who had worn their prostheses an average of 3.6 years is described. Eighteen conditions and criteria were used for evaluation.

Saunders, T. R., et al.: The maxillary complete denture opposing the mandibular bilateral distal extension partial dentures: Treatment considerations. *J. Prosthetic Dentistry*. 41:124, 1979.

The dentist should approach this common treatment combination cognizant of the oral destructive changes which may occur (1) loss of alveolar bone from the anterior part of the maxillary ridge, (2) down growth of the maxillary tuberosities (3) papillary hyperplasia of hard palate tissues (4) extrusion of lower anterior teeth (5) loss of bone beneath the removable partial denture bases. The institution of correct treatment initiatives is described to minimize the aforementioned.

Atwood, D. A.: Bone loss of edentulous alveolar ridges. *J. Periodontol*. special issue. 11–21, 1979.

The dentist who wishes to help his edentulous patient should be sensitive to all the variables that affect the reduction of residual ridges (RRR) and should treat the unique combination of factors existing in the individual patient.

Cephalometric studies by numerous authors in different parts of the world have shown that the mean rates of RRR fall into remarkably consistent patterns which are closely allied to time since extraction and time over which rate is measured. In every study, however, a wide variation has been shown between individuals in each time frame.

It is known that specialized bone cells such as osteoblasts and osteoclasts have life expectancies far shorter than human life. Therefore, their continued availability depends on the genetic and environmental capacity of the progenitor cells to produce them. Since RRR is a longitudinal and cumulative process persisting for the rest of the patient's life, senescence may become an important factor in the rate of RRR at certain stages because of aging changes in the number and viability of bone cells. Studies also have shown that the rate of RRR was greater in those who had potentially osteogenic tissue removed by alveolectomy than in those who had simple extractions.

Much work has been done in the study of local factors in bone resorption. Endotoxins from plaque, osteoclast-activating factor, prostaglandins, human gingival bone-resorption stimulating factor, and so forth are all factors that could be important to the rate of RRR. Other possible local biochemical factors, especially those under dentures, could be related to traumatogenic increased or decreased vascularity leading to changes in oxygen tension or temperature.

When the teeth are extracted, either there is little or no loading of the residual alveolar ridge (as in the nondenture wearer) with possible disuse atrophy of the ridge, or else the load is transmitted (in the denture wearer) through the denture teeth, the denture base, and the mucoperiosteum to the bone. Masticatory and swallowing contacts may average less than 15 minutes per waking day, but some patients clench and grind their teeth up to several hours a day, and these parafunctional forces place pathologic loads on their residual ridges.

It is possible that the rate of RRR is predetermined by the dentist who removes the teeth and by such surgical factors as the amount of attached gingiva that is removed, the amount of cortical bone that is removed, the amount of tissue reflection and dissection of mucoperiosteum from the bone, the amount of alveolectomy or alveolotomy; and the degree of tension resulting from close approximation of opposing tissues and tight suturing.

Mackay, H. F., etal.: Periodontal hazards of removable partial dentures. *J. Ontario Dental Assoc.* 55:17, 1978.

Accentuated plaque accumulation is the most damaging effect of most partial dentures. Contemporary reviews of fixed bridge design strongly favor retainers and artificial teeth that avoid the bulges and tight confines that accentuate plaque buildup. The present consensus is that partial dentures should be simple minimal structures that stand clear of gingival margins. Teeth with a poor periodontal prognosis are sometimes erroneously associated with removable prosthesis, where in fact correctly designed and maintained partial dentures rarely make the existing periodontal condition worse. The real factor influencing abutment health is whether the periodontal pathology could have been eliminated before the partial denture was provided and whether this state has been maintained by the patient.

Tautin, F.: Should dentures be worn continuously? *J. Prosthetic Dentistry.* 39:368, 1978.

Material is presented to show the potential problems in continuous denture wearing—the relation of continuous denture wearing to tissue changes such as severe inflammation and papillary hyperplasia and loss of alveolar bone. A maximum effort is needed to educate both patients and dentists about oral tissue health especially the length of time that dentures should be worn.

Miller, E. L.: Clinical management of denture induced inflammations. *J. Prosthetic Dentistry.* 38:362, 1977.

Four common lesions found under dentures; (1) Epulis Fissuration (2) Inflammatory Papillary Hyperplasia (3) Denture Sore Mouth (4) Denture Abused Mucosa are discussed along with methods of treatment.

Zakhari, K. N., McMurry, W. S.: Denture stomatitis and methods influencing its cure. *J. Prosthetic Dentistry.* 37:122, 1977.

This is a report on evaluating 3 methods for treating patients with denture stomatitis. Of 3 groups 2 were treated with tissue conditioning materials and one group had their dentures withheld and served as a control. There was no statistically significant difference in treatment effectiveness among all 3 groups. The authors conclude that use of tissue conditioning materials is helpful.

Academy of Denture Prosthetics: Principles, concepts and Practices in Prosthodontics—1976. *J. Prosthetic Dentistry.* 37:204, 1977.

These are guidelines and criteria developed by the Academy of Denture Prosthetics that qualify as principles, concepts and practices representative of the current thinking in the specialty of prosthodontics. Areas covered include (1) Consultation, history and oral examination (2) Diagnosis (3) Piognosis (4) Treatment planning (5) Prerestorative treatment (6) Prosthodontic treatment (fixed and removable)

Bocage, M., Lehrhaupt, J.: Lingual flange design in complete dentures. *J. Prosthetic Dentistry*. 37:499, 1977.

This lingual design advocated for completed lower dentures involves no changes in current concepts regarding minimum pressure, functional impression techniques. The sublingual horizontal extension suggested is placed in a biologically acceptable fashion by increasing the area of the denture, which enhances retention and stability.

Dail, R. A., and Kopczyk.: Removable partial dentures and oral health: a literature review. *Periodontal Abstracts*. 24:122, 1977.

The goal of partial denture treatment should be the conservation of the remaining functional natural teeth. An incorrectly designed removable partial denture may be a potentially destructive appliance. With meticulous oral and denture hygiene, an interested and motivated patient, and competent and rational principles of denture construction, the removable partial denture may be a useful treatment.

The removable partial denture may lead to conditions such as gingival inflammation, increased mobility of the abutment teeth, increased incidence of caries in abutment teeth, reduction of residual ridges, destruction of the periodontium, and a variety of tissue changes.

To eliminate or reduce these hazards, various aspects of design and construction of the removable partial denture should be carefully planned. The clasp assembly should be designed to transmit forces along the axis of the abutment teeth in a direction that can best be tolerated by the teeth. If a distal extension base is used, it should be designed to minimize the amount of stress transmitted to the periodontium of the abutment tooth as the denture base moves in function.

Soft tissue injury can be prevented by locating the major connectors in a favorable relationship to movable tissues, at the same time avoiding impingement of gingival tissues during insertion, removal, and function of the removable partial denture. Generally, the borders of all maxillary major connectors should be placed well away from the gingival marginal tissues.

To prevent the impingement of the gingival tissues by the minor connectors of the framework, guiding plane surfaces should extend no further gingivally than the junction of the gingival and middle thirds of the crown of the abutment tooth. To prevent further soft tissue injury, distal-extension partial dentures may be constructed with indirect retention, which minimizes the rotational movement.

Unless thorough analysis and planning of the desired occlusion are carried out, the occlusal forces created by the removable partial denture can be destructive and can actually defeat the objectives of the restoration. Any premature contact on inclined planes of the artificial teeth may result in the development of horizontal components of force, which tend to move natural teeth in a buccolingual or mesiodistal direction, thereby acting as a source of occlusal trauma.

Although research has indicated that the health of abutment teeth may be jeopardized when removable partial dentures are worn for some time, it has been suggested that the real threat to the natural dentition may be the inability and lack of interest of the patient to clean teeth, gingiva, and prosthesis.

Jones, P. M.: Complete dentures and the associated soft tissues. *J. Prosthetic Dentistry*. 36:136, 1976.

Some of the more common conditions of the soft tissues related to complete dentures are presented and discussed. Areas addressed are (1) Inflammatory processes under denture bases (2) Hyperplasias (3) Mechanical irritations (4) Chemical burns (5) White lesions (6) Ulcerative lesions (7) Malignant lesions (8) Occluded salivary gland duct.

Jani, R. M., and Bhargaua, K.: A histologic comparison of palatal mucosa before and after wearing complete dentures. *J. Prosthetic Dentistry*. 36:254, 1976.

Results showed an increase in thickness of palatal epithelium and the keratium layer in most patients the keratinized layer serves a protective function, and after denture insertion becomes thickened due to greater application of mechanical forces. The study and others indicate positively that the over all response of oral mucous membranes to well constructed dentures is satisfactory.

Mager, M. E.: The importance of the posterior border area in the construction of the full upper denture. *Dental Practice*. 20:421, 1970.

Boucher, C. O., et al.: Prosthodontic treatment for edentulous patients. ed 7. *The C. V. Mosby Co*. St. Louis, 1975.

It is generally agreed as evidenced by the above references that the posterior border of the maxillary denture must extend at least to the vibrating line, or in most instances, the denture should end at the vibrating line. Physiologically the vibrating line of the palate is the junction of the movable and immovable portion of the soft palate; not to be confused with the anatomic junction of the soft and hard palate. Location of the vibrating line relies on visual observation. Currently used techniques for determining the location of the vibrating line are based on (1) Phonation of the "ah" sound (2) The swallowing method and (3) The nose blowing method.

Carlsson, G. E., et al.: The current place of removable partial dentures in restorative dentistry. Based on longitudinal investigations of dento-gingivally supported partial dentures. *Dental Clin North Am*. 14.3. 553:68, 1970.

Carlsson, G. E., et. al.: Studies in partial denture prosthesis IV. A longitudinal study of mandibular partial dentures with double extension saddles. *Acta Odontol. Scand*. 23:443–472, 1965.

Carlsson and associates reported in 1965 and 1970 on the findings of a 4 year longitudinal study. They found an increased incidence of gingival marginal inflammation, mobile abutment teeth, pathologic gingival sulius depth, alveolar bone loss and carious lesions of uncrowned abutment teeth. They also reported a strong correlation between local pathologic manifestations and poor oral hygiene, however, they did not attempt to instruct their patients in oral hygiene.

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Brill, N., et al.: Ecologic changes in the oral cavity caused by removable partial dentures. *J. Prosthetic Dent.* 38:138, 1977.

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Baylink, D. J., et al.: Systemic factors in alveolar bone loss. *J. Prosthetic Dent.* 31:486, 1974.

Atwood, D. A.: Reduction of residual ridges in the partially edentulous patient. *Dent. Clinic North Am.* 747:54, 1973.

Brown, M. H.: Causes and prevention of fixed prosthodontic failure. *J. Prosthetic Dent.* 617:22, 1973.

Winland, R. C., and Young, J. M.: Maxillary complete denture posterior palatal seal: Variations in size, shape, and location. *J. Prosthetic Dent.* 256:61, 1973.

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Sheppard, I. M., et al.: Oral status of edentulous and complete denture wearing patients. *J. Am. Dent Assoc.* 83:614, 1971.

Robinson, C.: Clasp design and rest placement for the distal extension removable partial denture. *Dent. Clin North Am.* 583:94, 1970.

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Bhaskar, S. N., et al.: Inflammatory papillary hyperplasia of the oral mucosa: Report of 341 cases. *J. Am. Dental Assoc.* 81:949, 1970.

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Love, W. D., et al.: The etiology of mucosal inflammation associated with dentures. *J. Prosthetic Dent.* 18:515, 1967.

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Removable Prosthodontics Partial Dentures

Criterion 16: Design and Framework

Blatterfein, L., and Kaufman, E. G.: Prevention of problems with removable partial dentures. Council on dental materials, instruments, and equipment. *J. Am Dent Assoc.* 919:21, 1980.

This article provides dentists with recommendations from the council on dental materials, for the prevention of commonly encountered problems of removable partial denture restorations. Areas addressed are preparing abutment teeth, avoiding premature occlusion, maintaining health of the supporting tissues, avoiding fractures of framework components, improving esthetic appearance and improving fit. In each area a list of "do" and "do not" recommendations are given.

Tebrock, O. C., et al.: The effect of various clasping systems on the mobility of abutment teeth for distal-extension removable partial dentures. *J. Prosthetic Dent.* 511:6, 1979.

Three clasping systems were tested in 5 patients and measurement of abutment tooth mobility made. No difference in mobility was found during the 4 week test period. All 5 patients chose the I bar retainer as the design of choice due to its increased resistance to dislodgement. Periodic recall is stressed.

Schwalm, C. A., et al.: A clinical study of patients 1 to 2 years after placement of removable partial dentures. *J. Prosthetic Dent.* 380:91, 1977.

This study shows that an optimally constructed removable partial denture can give reasonable service for at least 2 years. The removable partial denture was still being worn satisfactorily by 93% of patients in the study. Teeth supporting the removable partial denture did not show any clinically significant increase in mobility or sulcular depth within the time span studied. In general there was mild inflammation of the gingival margins of the teeth contacted by components of the removable partial denture. It has been shown that removable partial dentures constructed using principles taught commonly in American Dental schools did not cause significant increases in tooth mobility or sulcus depth.

Reitz, P. V., et al.: An overdenture survey: Preliminary report. *J. Prosthetic Dent.* 37:246, 1977.

The authors review the indications for overdentures as a valid alternative to complete dentures. They also evaluated overdentures according to tissue tone and color, tooth mobility, loss of attached gingiva and pocket formation as criteria for success or failure of treatment. Though periodontal pathology and caries were identified as problems they support the tenet that conscientiously applied oral hygiene procedures by patients remain singularly important for overdenture success.

Brill, N., et al.: Ecologic changes in the oral cavity caused by removable partial dentures. *J. Prosthetic Dent.* 38:138, 1977.

The introduction of a removable partial denture affects the prevailing ecologic situation in terms of increased plaque formation. The rehabilitative effect of a removable partial denture may be safeguarded by controlling plaque formation by strict personal hygiene by the patient. In particular, proximal surfaces adjacent to denture bases should be stressed to patients as needing special attention. Simplification of the design of removable partial denture can also reduce their damaging potential. Further prophylactic measures such as topical fluoride and other chemicals should also be taken.

Grasso, J. E.: A new removable partial denture clasp assembly. *J. Prosthetic Dent.* 618:21, 1980.

A new clasp assembly is presented which incorporates desirable features of both the bar and circumferential clasps. With this clasp assembly the horizontal retentive arm and the vertical reciprocal component are designed to make simultaneous contact with their respective tooth surfaces during placement and removal of the prosthesis.

Krol, A. J.: Clasp design for extension-base removable partial dentures. *J. Prosthetic Dent.* 408:15, 1973.

Krol describes the design, advantages and disadvantages of the rest, proximal plate, and "I" bar clasp (RPI). The features of the RPI clasp are the proximal plate, mesial occlusal rest, and buccal "I" bar clasp which engages the infrabulge of the abutment tooth at the greatest mesiodistal prominence. Proponents of the RPI system claim it produces less stress on the abutment tooth when used with a distal extension base and it is more acceptable esthetically.

Stendahl, C. G., and Grob, D. J.: Detection of binding areas on removable partial denture frameworks. *Dent Clin North Am.* 101:6, 1979.

One often overlooked phase during removable partial denture fabrication is adjustment of the frame to ensure an accurate adaptation to abutment teeth. Failure to eliminate even minute projections from the internal surface of a framework casting may have an adverse effect on its long term prognosis. Disclosure of binding is best accomplished with an indicator that provides a thin sensitive, even opaque coating. Indicators used include rouge and chloroform; titanium dioxide and alcohol mixture and others have been utilized. The aims of adjustment are to maintain forces along the long axis of abutment teeth and ensure passivity—and in so doing create a more favorable prognosis.

Kratochvil, F. J., and Caputo, A. A.: Photoelastic analysis of pressure on teeth and bone supporting removable partial denture. *J. Prosthetic Dent.* 32:52, 1974.

The authors demonstrated that proper adjustment of the removable partial denture framework minimized torquing and tilting of abutment teeth adjacent to extension bases.

Campbell, L. D.: Subjective reactions to major connector designs for removable partial dentures. *J. Prosthetic Dent.* 507:16, 1977.

Simulated partial denture frameworks were fabricated for 12 dentists (subjects) who had intact dentitions and who had had no previous experience in wearing partial dentures. The outline of the major connectors was modified during a 1 week interval. Conclusions are: (1) preferences in maxillary major connector design were as follows: a) broad posterior strap, b) anteroposterior bar, c) ring-type design, d) full palatal coverage. (2) the mandibular lingual bar was chosen over the lingual plate by a 3:1 ratio, (3) the natural palatal metal finish was preferred to the highly polished finish, (4) in general patients adapted best to major connectors that covered the least amount of soft tissues.

Bergman, B., et al.: Periodontal and prosthetic conditions in patients treated with removable partial dentures and artificial crowns. A longitudinal two year study. *Acta Odontol Scand.* 29:621–628, 1971.

This is a two year longitudinal study in which 30 patients returned for treatment every 12 months. During these visits adjustments were made, oral hygiene re-emphasized and scaling performed. No significant breakdown of hard or soft tissues was found during the study and the investigators concluded that a carefully designed removable partial denture will cause little if any damage to remaining teeth when the patient returns regularly for careful examination, adjustment, scaling and oral hygiene remotivation.

Derry, A., and Bertram, U.: A clinical survey of removable partial dentures after 2 years usage. *Acta Odontol Scand.* 581:98, 1970.

This survey of 54 patients who had worn partial dentures for two years and been instructed in proper oral hygiene exhibited a lower incidence of caries and periodontal disease than the patients of Carlsson, et al.

Demer, W. J.: An analysis of mesial rest—I bar clasp designs. *J. Prosthetic Dent.* 36:243, 1976.

Demer believes that the RPI concept is the most important contribution to clasp partial denture design in the last 30 to 40 years. When used discerningly in situations where it is not contraindicated, it constitutes an excellent design for extension-base removable partial dentures. It has become the design of choice for an increasing number of dentists. Design of the framework, along with adequacy of support provided by the denture base and the nature of the occlusion may keep the forces transmitted to the teeth through the framework to a minimum and within physiologic tolerance. Neglect of these considerations may cause a framework of any design to become destructive.

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Levin, B.: Stressbreakers: A practical approach. *Dent Clin North Am.* 77:86, 1979.

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Cecconi, B. T., et al.: The effect of partial denture clasp design on abutment tooth movement. *J. Prosthetic Dent.* 44:56, 1971.

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Removable Prosthodontics Partial Dentures/

Criterion 17: Esthetics

Complete Dentures/

Criterion 24: Esthetics

Allen, E.P., Miller, P.D.: Coronal positioning of existing gingiva: short term results in the treatment of shallow marginal tissue recession. *J Periodontol* 60:316–9, 1989

Coronal positioning of existing gingiva over sites of tissue recession for esthetic enhancement was 97% successful in this study. Because esthetic considerations are a primary reason for patients seeking dental treatment, all techniques for improved esthetics coupled with preservation of health, function, and comfort are enthusiastically received by the profession and the public.

Berger, R.: Esthetic and pshysiologic considerations in metallic framework design. *Dent Clin North Am.* 1989 Apr;33(2):293–9.

The metal framework is the essential precursor to a successful porcelain fused to metal fixed partial denture. The framework should be rigid not by bulkiness, but by design. Pontics must be supported to span the edentulous space and replace the missing dentition while providing adequate space for a 1-mm porcelain veneer. The combined thickness of the metal and porcelain must be sufficient to achieve the desired color and vitality without producing a prosthesis that is morphologically overcontoured. To develop a framework that meets all the requirements of physiology, esthetics, and strength, a diagnostic waxup directs the positioning of connectors and allows planning of both form and support. A properly designed and positioned connector area should allow separation of the units by permitting the development of natural appearing labial embrasures. At the same time, the connector must, by engineered design, provide adequate structural strength to support the porcelain. Designing and fabricating the metallic framework for a fixed partial denture requires planning and an understanding of what is desired in the final form. An outline has been presented that details the connector form and placement and a technique has been suggested for developing a framework that provides optimal strength while allowing space for placement of esthetically contoured porcelain.

Murrell, G. A.: Complete denture esthetics. *Dent Clin North Am.* 1989 Apr;33(2):145–55.

Complete denture esthetics can no longer be considered solely a function of tooth selection and arrangement or the colors and contours of the denture bases. Denture esthetics must also include the entire face in which the expressions of inner feelings, personality, comfort, image, well-being, and perceptions of past dental experiences are all very evident. These hard and soft components all contribute to the complete denture esthetic result; they are inseparable and should be given every consideration when developing a successful complete denture esthetic restoration. Both the patient and the dentist must understand this interrelationship for optimal success.

Weinstein, M., et al.: Age and denture experience as determinants in patient denture satisfaction. *J Prosthet Dent.* 1988 Mar;59 (3):327–9.

Sixty-nine male patients participated in a self-evaluation survey measuring their satisfaction with maxillary and mandibular dentures. Patients generally had a high evaluation of their dentures, with the highest scores given to appearance. Age was not a significant predictor of denture success. Patients receiving their first dentures consistently had more difficulties in all categoriees of function, comfort, and appearance than patients with past experience with dentures.

Vervoorn, I. M., et al.: Assessment of denture satisfaction. *Community Dent Oral Epidemiol.* 1988 Dec;16(6):364–7.

The aim of this investigation was to evaluate the reliability and validity of a complaints questionnaire, designed to measure different aspects of denture satisfaction. Two groups of patients with full maxillary and mandibular dentures participated in the study. The patients in Group 1 (n = 113) were on a waiting list for new dentures, patients in Group 2 (n = 102) had recently had new dentures fitted. Five denture complaint scales were constructed from the questionnaire. The internal consistency (coefficient alpha) of the scales varied from 0.65 to 0.92. Furthermore, the scales showed a discriminatory ability between the patient groups (P less than or equal to 0.001) and significant Pearson correlation coefficients with satisfaction-related questions (r = 0.25–0.79). The scores on the scales can be considered a quantitative measure of denture satisfaction.

Murrell, G. A.: Esthetics and the edentulous patient. *J Am Dent Assoc.* 1988 Sep;117(4):57E–63E.

Most individuals undergo some degree of psychological shock, depression, and loss of self-esteem after the loss of their teeth. Optimum success in the treatment of the edentulous patient can no longer be limited to the proper fit, function, speech, selection, and arrangement of teeth. In addition, today's dentists must use treatment strategies that include proper psychological management, caring, and recognition of the importance of the patient's perception of what is personally esthetic. This article addresses the esthetic considerations of this restorative challenge.

Budtz-Jorgensen, E.: Materials and methods for cleaning plates. *J. Prosthetic Dent.* 42:618, 1979.

This review deals with cleaning dentures. Techniques and agents used to clean dentures include brushing, pastes, powders, ultrasonic agitation, and numerous chemicals such as disinfectants and enzymes. Neglect, on the part of both patients and dentists, is seriously regarded in this critical aspect of prevention. Use of a disclosing solution may be of value. Development of a cleaning solution that can keep dentures plaque-free with a daily soaking is needed.

Cade, R. E.: The role of the mandibular anterior teeth in complete denture esthetics. *J. Prosthetic Dent.* 368:70, 1979.

This study finds that mandibular anterior teeth play an important role in patient appearance. The mandibular anterior teeth showed more in older individuals. The study emphasizes the need for greater esthetic consideration when selecting and arranging mandibular anterior teeth.

Vig. R., and Brundo, G.: The kinetics of anterior tooth display. *J. Prosthetic Dent.* 39:502, 1978.

The research entailed surveying persons of varied ages to determine (1) the relationship of lips and teeth (2) changes that occurred with aging in anterior tooth exposure. The results suggested that accepted guidelines for setting anterior teeth

might be misleading because the mandibular arch played a greater role than had been previously reflected in the literature. Specifically the data indicated that in patients over 60 years of age, the mandibular incisor teeth were displayed to approximately the same extent that maxillary incisor teeth were displayed by patients under 30 years of age. Other findings were (1) people with short upper lips displayed more maxillary tooth structure than people with long upper lips; (2) the longer the upper lip the more the mandibular teeth were exposed. (3) Men displayed more of the mandibular incisors than women.

Smith B. J.: Esthetic factors in removable partial prosthodontics. *Dent Clin North Am.* 53:63, 1979.

The author comprehensively discusses all areas of partial denture construction which may affect esthetics. He notes the importance of good esthetics in motivating the patient to wear the denture and significant contribution the removable partial denture makes to the patients' appearance and overall satisfaction. Esthetics is often the overriding concern of the patient. The author discusses the denture base and critical decision that must be made in restoring anterior teeth as to whether a labial flange must be used. When considerable alveolar bone resorption has occurred the author says a labial flange must be used in order to replace the missing tissue and provide proper lip support. Anterior flanges should ideally extend to the reflection of the mucosa in the labial sulcus to avoid the horizontal edge of the flange being visible. Proper contour and thickness of the flange is also important. Artificial teeth have three roles, esthetics, phonetics and incising. (in the anterior). They should be the same color, shape and size, as their natural predecessors and occupy the same position. Framework considerations are also reviewed in relation to clasp design and esthetics for the patient.

Tautin, F. S.: Denture esthetics is more than tooth selection. *J. Prosthetic Dent.* 127:30, 1978.

Selection of proper mold and shade is one aspect of esthetics. Compensating for lost alveolar bone, correctly positioning anterior teeth for lip support and re-establishment of the VDO in combination with proper tooth selection creates good denture esthetics. Proper contour and normal physiological movement are also essential for an esthetic outcome.

Levin, B.: A review of artificial posterior tooth forms including a preliminary report of a new posterior tooth. *J. Prosthetic Dent.* 38:3, 1977.

Levin presents a well documented report on the background and history of posterior tooth forms. Research done on mastication and the efficiency of tooth forms with various test foods is reviewed and compared with forces possible from artificial and natural dentitions. Most dental schools are now using monoplane occlusion for complete dentures though there is evidence to show that a with a given minimum of force, cusp teeth will penetrate a bolus better than 2 flat surfaces. Levin suggests the use of metal blade teeth opposing acrylic resin teeth in the posterior.

Landa, L. S.: Practical guidelines for complete denture esthetics. *Dent Clin North Am.* 21:2, 285, 1977.

This is a comprehensive review of all factors dealing with denture esthetics. The best time to gain insight into the esthetic problems of a patient is at the first meeting with that patient. Proper placement of teeth should be functional, esthetically and psychologically pleasing. The author discusses shade selection, tooth size and notes that attempts to correlate tooth form with facial form, sex, and patient personality profile does not stand up under scientific investigation (in a thesis by Hallarman). A section on trouble shooting where specific esthetic problems are listed with their probable causes so they may be corrected, is included.

Heartwell, C., and Rahn, A.: Syllabus of complete dentures, ed. 3. Philadelphia, *W. B. Saunders Co.*, p. 279, 1969.

These authors contend that the interincisal distance increases with age and that the mandibular teeth become more visible.

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Jamshidi, M.: Selection of tooth color for the fixed partial prosthesis patient. *J. Oreg Dent Assoc.* 12:3, 54:5, 59., 1978.

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Bergman, B., and Carlsson, G. E.: Review of 54 complete denture wearers Patients' opinions 1 year after treatment. *Acta Odontol Scand.* 30. 399:414, 1972.

Brewer, A. A.: Selection of denture teeth for esthetics and function. *J. Prosthetic Dent.* 23:368, 1970.

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Carlsson, G. E., et al.: Patient factors in appreciation of complete dentures. *J. Prosthetic Dent.* 322:8, 1967.

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Removable Prosthodontics Complete Dentures/

Criterion 22: Vertical Dimension of Occlusion

Unger, J.W.: Comparison of vertical morphologic measurements on dentulous and endentulous patients *J. Prosthetic Dent.* 64:232–4, 1990.

Through an analysis of cephalometric films, the vertical dimension of occlusion of a group of edentulous patients was compared with the vertical dimension of occlusion in a previously studied group of dentulous patients. In addition, the vertical dimension of occlusion in the edentulous group was measured after 20 years of denture wearing. The results indicated a remarkable correlation in the vertical dimension of occlusion established initially for the edentulous patients when compared with the measurements made for dentulous patients of a similar age range. The mean change in the vertical dimension of occlusion after 20 years of wearing complete dentures was 2.5 mm.

Russotto, S. B.: The role of Candida Albicans in the pathogenesis of angular cheilosis. *J. Prosthetic Dent.* 44:243, 1980.

The study results show (1) the incidence of C. Albicans infection is greater than previously believed (2) angular cheilosis and denture sore mouth are often found together. The etiology of both lesions is C. Albicans. (3) Systemic factors may be responsible for intraoral candidiasis, but they are of secondary importance in the etiology of angular cheilosis. The primary etiologic agent is C. Albicans. (4) Nutritional deficiency or reduced vertical dimension of occlusion are contributing factors in the pathogenesis of angular cheilosis, but C. Albicans is the agent primarily responsible for the lesions.

Feldman, S., et al.: Rest vertical dimension determined by electromyography with biofeedback as compared to conventional methods. *J. Prosthetic Dent.* 1980.

Rest vertical dimension is defined as the length of the face when the mandible is in rest position. The dentist is continually confronted with problems related to the determination of rest vertical dimension when fabricating complete dentures. He usually makes use of conventional methods for determining the VDO such as swallowing, phonetics and the physiologic approach. This study was undertaken to determine if electromyography with biofeedback can be utilized to produce a more reliable determination of rest vertical dimension than conventional methods. It was found that (1) Electromyography with biofeedback appeared to produce a more consistently reliable determination of rest vertical dimension than conventional methods when used with edentulous subjects.

George, J. P., and Boone, M. E.: A clinical study of rest position using the Kinesiograph and Myomonitor. *J. Prosthetic Dent.* 41:456, 1979.

Silverman, M. M.: A clinical study of rest position using the Kinesiograph and Myomonitor—Letter to the editor. *J. Prosthetic Dent.* 42:358, 1979.

A reliable determination of rest vertical dimension still haunts the profession. Two investigations above using the Kinesiograph and Myomonitor to study rest vertical dimension pointed out the needs for flexibility and comparison of rest vertical dimension position before, during, and after mandibular closure to maximum intercuspation.

Williamson, E. H., et al.: A longitudinal study of rest position and centric occlusion. *Angle Orthod.* 45:130, 1975.

In a 15 year longitudinal study rest position was found to have a small range of stability whereas the VDO was more reliable.

Atwood, D. A.: A critique of research of the rest position. *J. Prosthetic Dent.* 16:848, 1966.

In a cephalometric study Atwood found this method to be most accurate for determining rest position. In making his analysis he had patients wet the lips, say "M" and relax.

Swerdlow, H.: Vertical dimension—literature review. *J. Prosthetic Dent.* 15:241, 1965.

Swerdlow felt that phonetic methods were consistently more reliable than the swallowing method for determination of interocclusal distance.

Niswonger, M. E.: The rest position of the mandible and centric relation. *J. Am. Dent Assoc.* 21:1572, 1934.

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Niswonger established rest position by having patients swallow and relax to the rest position. He felt that rest vertical dimension is a voluntary position and that the patient can be told to find a most comfortable position.

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Ohman, S. C., et al.: Angular cheilitis: a clinical and microbial study. *J. Oral Pathol.* 1986 Apr;15(4):213–7.

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Pound, E.: Controlling anomalies of vertical dimension and speech. *J. Prosthetic Dent.* 2:124–35, 1976.

Tallgren, A.: The continuing reduction of the residual alveolar ridges in complete denture wearers: A mixed-longitudinal study covering 25 years. *J. Prosthetic Dent.* 120:32, 1972.

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Sherman, H.: Phonetic capability as a function of vertical dimension in complete denture wearers—a preliminary report. *J. Prosthetic Dent.* 621:32, 1970.

Tallgren, A.: Positional changes of complete dentures. A seven year longitudinal study. *Acta Odontol Scand.* 539:61, 1969.

Tueller, V. M.: The relationship between the vertical dimension of occlusion and forces generated by closing muscles of mastication. *J. Prosthetic Dent.* 284:8, 1969.

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