

Management of Temporomandibular Disorders

National Institutes of Health
Technology Assessment Conference Statement
April 29–May 1, 1996

About The NIH Technology Assessment Program

NIH Technology Assessment Conferences and Workshops are convened to evaluate available scientific information related to a biomedical technology. The resultant NIH Technology Assessment Statements and published reports are intended to advance understanding of the technology or issue in question and to be useful to health professionals and the public.

Some Technology Assessment Conferences and Workshops adhere to the NIH Consensus Development Conference (CDC) format because the process is altogether appropriate for evaluating highly controversial, publicized, or politicized issues. In the CDC format, NIH Technology Assessment Statements are prepared by a nonadvocate, non-Federal panel of experts, based on (1) presentations by investigators working in areas relevant to the consensus questions during a 1 1/2-day public session, (2) questions and statements from conference attendees during open discussion periods that are part of the public session, and (3) closed deliberations by the panel during the remainder of the second day and morning of the third. Each statement is an independent report of the panel and is not a policy statement of the NIH or the Federal Government.

Other Technology Assessment Conferences and Workshops are organized around unique formats. Usually, speakers present findings or perspectives on the issue. Policy implications may be discussed. The public is invited to address questions to the speakers. A report of the findings can emerge in one of a variety of formats including publication in a clinical or scientific journal.

Reference Information

For making bibliographic reference to this Technology Assessment Statement, it is recommended that the following format be used, with or without source abbreviations, but without authorship attribution:

Management of Temporomandibular Disorders. NIH Technol Assess Statement 1996 Apr 29–May 1; 1–31.

Publications Ordering Information

*NIH Consensus Statements, NIH Technology Assessment Statements, and related material are available by writing to the NIH Consensus Program Information Center, P.O. Box 2577, Kensington, Maryland 20891; by calling toll free **1-888-NIH-CONSENSUS** (1-888-644-2667); or by visiting the NIH Consensus Development Program home page on the World Wide Web at <http://consensus.nih.gov>.*

Management of Temporomandibular Disorders

National Institutes of Health
Technology Assessment Conference Statement
April 29–May 1, 1996

Abstract

Objective. To provide physicians and the general public with a responsible assessment of management approaches to temporomandibular disorders (TMD).

Participants. A non-Federal, nonadvocate, 15-member panel representing the fields of clinical dentistry, medicine, surgery, cellular and molecular biology, epidemiology, biostatistics, immunology, behavior and social sciences, pain management, and tissue engineering. In addition, 23 experts in clinical dentistry, medicine, surgery, cellular and molecular biology, epidemiology, biostatistics, immunology, behavioral and social sciences, pain management, and tissue engineering presented data to the panel and a conference audience of 1,083.

Evidence. The literature was searched through Medline and an extensive bibliography of references was provided to the panel and the conference audience. Experts prepared abstracts with relevant citations from the literature. Scientific evidence was given precedence over clinical anecdotal experience.

Consensus Process. The panel, answering predefined questions, developed its conclusions based on the scientific evidence presented in open forum and the scientific literature. The panel composed a draft statement that was read in its entirety and circulated to the experts and the audience for comment. Thereafter, the panel resolved conflicting recommendations and released a revised statement at the end of the conference. The panel finalized the revisions within a few weeks after the conference.

Conclusions. Consensus has not been developed across the practicing community regarding which TMD problems should be treated, and when and how they should be treated. The preponderance of the data do not support the superiority of any method of initial management of most TMD problems. The efficacy of most treatment approaches is unknown, as most have not been adequately evaluated in long-term studies and virtually none in randomized controlled trials. Although noninvasive therapies are clearly preferred for the vast majority of TMD problems, a small percentage of patients who have persistent and significant pain and dysfunction and for whom more conservative treatment has failed may be considered for surgical intervention. Professional education is needed to ensure proper and safe practice in the treatment of TMD, especially with regard to pharmacological, surgical, and behavioral approaches.

Introduction

Temporomandibular disorders (TMD) refer to a collection of medical and dental conditions affecting the temporomandibular joint (TMJ) and/or the muscles of mastication, as well as contiguous tissue components. Although specific etiologies such as degenerative arthritis and trauma underlie some TMD, as a group these conditions have no common etiology or biological explanation and comprise a heterogeneous group of health problems whose signs and symptoms are overlapping, but not necessarily identical. Depending on the practitioner and the diagnostic methodology, the term TMD has been used to characterize a wide range of conditions diversely presented as pain in the face or jaw joint area, headaches, earaches, dizziness, masticatory musculature hypertrophy, limited mouth opening, closed or open lock of the TMJ, abnormal occlusal wear, clicking or popping sounds in the jaw joint, and other complaints. The severity of these presenting conditions may range from noticeable but clinically insignificant signs to seriously debilitating pain or dysfunction.

Given this variation among the problems labeled TMD, it is not surprising that controversy has emerged. Even the name TMD is not universally endorsed. Generally accepted, scientifically based guidelines for diagnosis and management of TMD are still unavailable. Even so, practitioners representing a variety of disciplines and specialties have responded to their patients' needs by developing and employing a broad range of treatment approaches that include educational or behavioral counseling, pharmacological or mechanical approaches, occlusal therapies, and a variety of surgical procedures, or combinations thereof. In many cases, patients have improved, and in others—for example, in cases involving the use of certain alloplastic implants—the results have been disastrous. For the majority of TMD patients, the absence of universally accepted guidelines for evaluation and diagnosis compromises the goals of consistent and conservative therapy. The lack of standard treatment protocols accepted across professional specialties means that many patients and practitioners may attempt therapy with inadequately tested approaches.

Although epidemiological data are inadequate, the total number of TMD sufferers in this country can be roughly estimated at more

than 10 million, and concern about the safety and efficacy of their care requires that we achieve a better understanding of these health problems. Not only must valid and reliable criteria for diagnosis and measurement be developed, but the rationales for and effectiveness of a variety of treatments currently in use must be examined as well.

To address these issues, the National Institute of Dental Research and the NIH Office of Medical Applications of Research convened a Technology Assessment Conference on Management of Temporomandibular Disorders, with the encouragement of patient-based support groups. The conference was cosponsored by the National Institute of Arthritis and Musculoskeletal and Skin Diseases, the National Institute of Neurological Disorders and Stroke, the National Institute of Nursing Research, and the NIH Office of Research on Women's Health.

This conference brought together specialists in clinical dentistry, medicine, surgery, cellular and molecular biology, biostatistics, epidemiology, immunology, behavioral and social sciences, pain management, tissue engineering, and representatives of the public, including TMD patients and advocacy groups. After 1½ days of presentations and audience discussion, this independent, non-Federal technology assessment panel weighed the scientific evidence and the experience of patients and practitioners and developed a draft statement that addressed the following questions:

- What clinical conditions are classified as temporomandibular disorders, and what occurs if these conditions are left untreated?
- What types of symptoms, signs, and other assessments provide a basis for initiating therapeutic interventions?
- What are effective approaches to the initial management and treatment of patients with various TMD subtypes?
- What are effective approaches to management and treatment of patients with persistent TMD pain and dysfunction?
- What are the most productive directions for future research, and what types of new collaborations and partnerships should be developed for pursuing these directions?

Question 1: What Clinical Conditions Are Classified as Temporomandibular Disorders, and What Occurs If These Conditions Are Left Untreated?

Classification of Clinical Conditions

From the information provided, the clinical conditions usually classified as TMD include those with pain or dysfunction in the joint or contiguous structures. These conditions are linked in their presentation by their common signs and symptoms. Given the lack of epidemiological information and the collection of as yet undefined etiologies that are likely to be described as TMD, a conventional disease classification system would be difficult to describe, possibly misleading, and unlikely to receive broad acceptance. For the time being, therefore, classification must depend primarily on the detailed description of symptoms and underlying conditions. “Parameters of Care for Oral and Maxillofacial Surgery” (1995), developed by the American Association of Oral and Maxillofacial Surgeons, provides useful information of this type.

Conditions primarily affecting the muscles of mastication include systemic diseases of muscles such as polymyositis, dermatomyositis, hereditary myopathies, and changes in the musculature secondary to functional disturbances. Conditions affecting the TMJ include arthritis, ankylosis, growth disorders, recurrent dislocation, neoplasia, condyle fracture, and systemic illness. With respect to both muscular and joint changes, those classified as functional affliction of the muscle or pathology of the joint or a combination of both are most often categorized as TMD. It should be noted that affliction of either the joint or the muscle may lead to secondary changes in the other structure that become a further source of pain and functional impairment.

Although current diagnostic classifications of TMD are based on signs and symptoms rather than on etiology, these signs and symptoms should be classified in the larger context of other muscle and joint disorders or in the category of pain disorders. Lessons can be learned from diagnostic and therapeutic approaches to other joint and muscle diseases. For example, less controversy exists in hip joint diagnosis or treatment, where etiologic classifications are better established. On the other hand, there appears to be similar controversy in conditions of the lumbo-sacral spine, such as low back pain. As with TMD,

diagnosis and treatment of low back pain may involve a number of potential etiologies that are difficult to differentiate and require participation of multiple disciplines or specialities.

What Occurs If These Conditions Are Left Untreated?

Well-designed, representative cross-sectional and longitudinal studies are scarce. Consequently, the natural history of TMD is not well defined. In addition, most studies are descriptive, with analyses that are predictive or explanatory virtually absent. The limited, population-based epidemiological data available indicate that the prevalence of self-reported signs and symptoms is between 5 and 15 percent, with peak prevalence in young adults (20–40 years of age). Although signs associated with TMD have been reported with equal frequencies for men and women, some studies show greater prevalence of symptoms (e.g., self-reported facial pain) in women of child-bearing age, and a number of clinical case series studies have reflected an overwhelming predominance of women in the third and fourth decades. The reported discrepancies in gender differences require explanation. The lower prevalence of TMD signs and symptoms at older ages reported in cross-sectional data is consistent with the self-limiting nature of such signs and symptoms, and the few longitudinal clinical studies support these findings. There is no information on ethnic or racial variation in these rates.

In clinical case series studies in which conservative, reversible, noninvasive therapy was emphasized, the presenting signs and symptoms appeared to improve in the vast majority of patients. In remaining patients, symptoms may persist, recur, or worsen. Few data are available that assess the long-term course of these patients in the absence of an intervention. Limited data indicate that many symptomatic people do not seek treatment. Similarly, minimal data are available from which to assess the natural history of this group of patients. Although it has been suggested that societal barriers and prejudices often prevent appropriate treatment of TMD patients, these relationships have not been documented in the research.

Question 2: What Types of Symptoms, Signs, and Other Assessments Provide a Basis for Initiating Therapeutic Interventions?

Any initiation of therapy must be based on a thorough and sensitive analysis of the patient. Although some signs and symptoms associated with certain intra- and extracapsular disorders are well established, the etiology of others remains ambiguous and a challenge to the practitioner. Although numerous assessment methods are available, lack of evidence of the diagnostic value of these tools (i.e., their validity, reliability, specificity, sensitivity, and cost-effectiveness) contributes to this ambiguity. Diagnosis and initial treatment, therefore, often depend on the practitioner's experience and philosophy, rather than on scientific evidence.

Nonetheless, the consensus is that diagnosis and initiation of treatment should be based on data from physical examination and should include medical and dental history; information about audiological, speech, and swallowing problems, pain, and dysfunction; and consideration of psychosocial factors, as well as data from imaging and other diagnostic tests. Evaluation should encompass examination of orofacial tissues, musculature, and neurological function. Particular attention should be paid to determinations of functional range of motion, occlusal status, existence of parafunctional conditions (e.g., clenching, grinding), and the presence of joint or muscle tenderness and cutaneous hyperalgesia. Psychosocial assessments should determine the extent to which pain and dysfunction interfere with or diminish the patient's quality of life. However, the consideration of psychosocial factors has the potential for inappropriate use, and it is imperative that such assessments be managed by skilled professionals using validated instruments.

Currently available epidemiological evidence suggests that TMD is frequently self-limiting. The practitioner and the patient must strive to develop a treatment plan that is evidence based and patient centered. In devising any treatment plan, the practitioner must weigh the patient's perception of pain and dysfunction and the impact of these on the patient's quality of life. In the absence of overt pathology, some patients and practitioners may work together to implement a program of patient self-management with education and an understanding of the role of personal factors. If the patient does not obtain adequate relief from

these measures, a number of conservative, noninvasive, and reversible treatments can next be considered.

At present the evidence is insufficient to warrant prophylactic intervention for management of TMD, nor are there data providing clear evidence that orthodontic treatment prevents, predisposes to, or causes TMD. Even so, some practitioners have carried out occlusal adjustments, extensive restorations, or management of displaced disks or joint sounds in the absence of pain or loss of function.

Given current evidence, special emphasis should be placed on the avoidance of extensive restorative procedures to treat a disorder that may change over time.

Question 3: What Are Effective Approaches to the Initial Management and Treatment of Patients With Various TMD Subtypes?

Initial management is defined as the first treatment the patient receives after seeking care. Pain and dysfunction of the masticatory apparatus can be a frightening and disabling experience for patients. The TMJ is important functionally with regard to speech, social interactions, mastication, swallowing, and other oral functions, as well as hearing, in some cases. Patients seeking care deserve careful attention, given the importance of this area of the body.

The initial management of TMD described below assumes that underlying systemic or overt joint diseases have been identified and addressed. Patients with joint arthropathies and painful jaw muscle conditions associated with systemic disease require treatment for the underlying disease. While these patients may also need therapy directed specifically to the TMJ and related structures, such treatment must be carefully coordinated with that provided for systemic disease. When there is disease of the TMJ itself (such as neoplasias, which frequently require surgical therapy), that disease must be the primary focus of treatment.

Although a vast array of therapeutic modalities have been offered for TMD patients, there is a paucity of clinical studies, and especially randomized controlled clinical trials, to guide management of these patients. Given that most patients have a self-limited disorder and that a variety of different therapies appear to result in similar improvements in pain and dysfunction, caution is urged with regard to use of invasive and other irreversible treatments, particularly in the initial management of TMD.

A number of noninvasive and reversible therapies are widely used and appear to help many patients. Optimally, these therapies should have low morbidity and minimal alteration of underlying anatomic structures. These therapies include:

- **Supportive patient education.** Initial attention should be given to the issue of patient education on what is known about TMD and the fact that most of these problems follow a benign course. Many experts recommend that patients undergo education directed at eliminating certain behaviors perceived to be harmful, such as

clenching and grinding. Some experts recommend exercise and stress management. Rest and dietary modifications may help some patients.

- **Pharmacologic pain control.** Medication may be useful for initial symptom management. The medications useful for TMD are similar to those useful for other painful musculoskeletal conditions. Non-steroidal anti-inflammatory drugs (NSAIDs) and opiates are the mainstay of pharmacological pain treatment. Some clinicians also have found muscle relaxant medications and low-dose antidepressants of a sedating type to be useful in initial management of TMD. Other medications also have been used for specific indications. In all cases, the clinician must weigh the risk of side effects against potential benefits, along with his or her own professional competence in the administration and management of such medications.
- **Physical therapy.** Physical therapy applications to TMD include a wide variety of evaluative techniques and treatment modalities that have been commonly used in other neurological and musculoskeletal disorders. These therapies generally are conservative and noninvasive. Benefits to TMD patients have been described, although few data are available to document these results.
- **Intraoral appliances.** Stabilization splints are considered noninvasive and reversible and are recommended by many experts for early treatment of these patients. It is important that these appliances are of a type that does not lead to major alteration of the patient's occlusion. Repositioning appliances may appear to be noninvasive but have potential for creating such irreversible changes in occlusion and, consequently, the possibility of precipitating other problems.
- **Occlusal therapy.** Much controversy surrounds the use of occlusal therapy. The advocates argue that occlusal abnormalities and/or joint manipulation precipitate the development of TMD. Occlusal therapies are aimed at modification of the occlusion itself through alteration of the tooth structure or jaw position. Given that this

latter therapy is irreversible, and given that the superiority of this treatment over reversible therapies has not been demonstrated in randomized controlled prospective trials, this form of occlusal adjustment probably will not represent best practice for initial management of TMD. However, assessment of occlusion is necessary as part of the initial oral examination to identify and eliminate gross occlusal discrepancies such as those that may inadvertently occur as a result of restorative procedures.

After these initial therapeutic interventions, a small number of patients may continue to exhibit symptoms associated with the TMD constellation of conditions. These patients will require consideration for longer term and/or more invasive therapies.

Question 4: What Are Effective Approaches to Management and Treatment of Patients With Persistent TMD Pain and Dysfunction?

An important minority of TMD patients progress to persistent pain and/or dysfunction. This minority represents a heterogeneous group of disorders. There are few randomized controlled clinical trials to give us guidance regarding the treatment of patients with persistent pain. Although many of the conservative modalities that were implemented in the initiation of treatment may continue to be used, other strategies may require consideration during this phase of treatment.

For the patient with episodic signs and symptoms, a noninvasive, conservative approach should be implemented. For the patient with persistent, nonremitting signs and symptoms, a stepwise approach should be implemented. In some cases, these treatments are intended to provide symptomatic care, whereas in others they are intended to alter the course of the condition. Although some treatments restricted to the TMJ and oral structures have been overemphasized, other treatments such as pharmacotherapeutics appear to have been underutilized, or inappropriately used.

As the intervention becomes increasingly aggressive, invasive, and irreversible, the patient and practitioner should share a common understanding of the scientific basis, indications, goals, risks and benefits, and prior history of the proposed intervention. It should be clearly recognized that surgery is indicated in only a small percentage of patients.

From the data provided, no single treatment or combination of procedures was demonstrated to be effective in randomized controlled clinical trials. Given the lack of evidence, no specific recommendations can be made. However, the following would be useful to advance the care of patients with persistent TMD pain and dysfunction.

Pharmacological Therapies

The principles for management of the pain associated with persistent TMD are the same as those for treatment of other chronic pain conditions. Opiates and NSAIDs are recognized as mainstays for analgesic management and should be implemented commensurate with the level of pain.

A major concern regarding the use of opiates in the past has been the potential of addiction, analgesic tolerance, uncontrolled side effects, and toxicity associated with long-term use. More recent work, however,

suggests that these concerns often are not warranted and that many chronic pain patients, treated with adequate doses of opiates, can achieve successful control of symptoms without adverse effects.

Adjuvant analgesics represent a diverse group of drugs, including tricyclics, antidepressants, anticonvulsants, membrane stabilizers, sympatholytic agents, and others. These groups of drugs are likely to be more efficacious in neuropathic pain states but may be considered for patients who respond poorly to or are unable to tolerate NSAIDs and opiates.

Pain disorders may result in impaired sleep. Hypnotics may be useful to improve sleep patterns, which in turn benefit the patient's overall health status. Many pain experts believe that a major comorbidity associated with chronic pain is depression and that medical therapy of depression may confer benefit to such patients.

Occlusal Therapies

Some experts believe occlusal adjustment may be helpful in this group of patients, and some experts also argue that occlusal adjustment should be performed before surgical procedures. Randomized trials are needed to establish the effectiveness of such approaches. Based on available information, however, occlusal adjustments that permanently alter a patient's occlusion should be avoided.

Surgical Approaches

Randomized controlled clinical trials to support the efficacy of individual surgical procedures have not been performed. A spectrum of surgical interventions has been applied to the group of patients with pathology of the TMJ. These approaches include arthrocentesis, arthroscopy, arthrotomy/arthroplasty, condylotomy, orthognathic surgery, and even total TMJ replacement.

Indications for surgery include one or more of the following: moderate to severe pain, dysfunction that is disabling, and/or evidence of pathological conditions. Experts who perform these procedures quote high rates of success in this highly select group of patients; however, a small percentage of these patients experience deterioration of their conditions.

The use of certain alloplastic implants in surgery for TMD has resulted in disastrous consequences for many patients who have undergone such treatment. Consequently, utmost caution must be utilized in considering the use of any implants. At the same time, it is recognized that certain patients are in need of implants, and newer implant designs need to be fully assessed as quickly as possible. For patients who already have had implant or other invasive surgery, additional surgical interventions (with the possible exception of implant removal) should be considered only with great caution, since the evidence indicates that the probability of success decreases with each additional surgical intervention. For such patients, the most promising immediately available treatment may be a patient-centered, multidisciplinary, palliative approach.

Psychosocial Issues

Patients with persistent TMD problems may suffer psychologically and socially because of pain and dysfunction. Failed treatments and recurrent pain episodes contribute to life stresses with a pattern of frustration, hopelessness, and even depression. The life stress associated with persistent pain and dysfunction related to TMD has not been adequately understood from the patient's perspective or from the perspective of impact on social functioning.

Psychological treatment strategies have not always been tailored to the individual needs of TMD patients. Nor does there appear to be a well-accepted model for supportive treatment environments for patients who have entered the phase of TMD characterized by persistent pain and dysfunction, although some such approaches are under development. Along with functional impairment, patients with TMD may experience esthetic impairment associated with failed interventions and/or persistent pain. The resulting negative self-image, disappointment, and frustration add to the stress associated with TMD. Psychological strategies established for other chronic conditions may be useful in supporting patients managing persistent pain, social debilitation, and the ensuing life stress associated with TMD. Relaxation and cognitive behavioral therapies have been shown to be effective in managing chronic pain, although data from controlled studies are not available regarding their efficacy in the management of pain associated with TMD.

Question 5: What Are the Most Productive Directions for Future Research, and What Types of New Collaborations and Partnerships Should Be Developed for Pursuing These Directions?

The following directions for future research should be considered:

- At present, TMD is best described and diagnosed in the context of detailed information about presenting symptoms and full assessment of related factors and conditions. A more conventional disease classification system would be difficult to develop, and could be misleading, given that (a) necessary epidemiological information is lacking and (b) the etiologies underlying the conditions called TMD have not been adequately defined and described. Carefully designed, analytical, cross-sectional, population-based studies with appropriate clinical measures and biological markers should be conducted to identify the prevalence of presenting signs and symptoms for TMD, excluding well-defined systemic conditions. These studies should identify associations with potentially predisposing and precipitating conditions. Frequently reported gender differences warrant further investigation.
- Validated diagnostic methods for identification and classification of TMD patients are needed. The diagnostic value of these assessment techniques should be established with respect to the criteria of sensitivity, specificity, reliability, and cost-effectiveness.
- When sufficient data are available, a multidisciplinary classification system based on measurable criteria should be developed as the first step in a rational approach to developing diagnostic protocols and appropriate treatment modalities. This approach should lead to a labeling of “subtypes” that could permit the elimination of the term TMD, which has become emotionally laden and contentious.
- Randomized controlled clinical trials are needed to determine the efficacy of TMD treatments. These studies should include measures of both clinical outcome and cost-effectiveness.
- Longitudinal studies should be conducted to identify both the natural history of the nonspecific signs and symptoms associated with TMD and the potential risk factors using predictive and explanatory statistical methodologies. These studies should be

designed to elucidate the relationship between signs and symptoms, and etiology.

- Treatment protocols should be developed for approaches aimed at fostering the patient's control and sustaining or enhancing social functioning. Research should also be directed at understanding self-management of TMD signs and symptoms.
- Incentives should be provided for the private practice and academic communities to collaborate in designing and conducting well-controlled clinical trials of treatments for these conditions.
- There is an obvious need for basic research with respect to TMD. This research should include both human and animal research into the mechanisms of persistent pain associated with the orofacial region, the risk factors for persistent pain and/or dysfunction, the risk factors and cost-benefit considerations of long-term opioid use in the treatment of TMD, the etiology of gender differences, and the biomechanics of the TMJ and implants.
- Innovative methods directed at the construction of prostheses from living tissue should be encouraged. Bioengineers can make important contributions to TMD research, including studies on the mechanical properties, biostability, and biocompatibility of materials used in implants.

Conclusions

Evidence presented at the Technology Assessment Conference led to the following conclusions:

- There are significant problems with present diagnostic classifications of TMD, because these classifications appear to be based on signs and symptoms rather than on etiology.
- Consensus has not been developed across the practicing community regarding many issues, including which TMD problems should be treated and when and how they should be treated.
- The preponderance of the data does not support the superiority of any method for initial management of most TMD problems. Moreover, the superiority of such methods to placebo controls or no treatment controls remains undetermined. Because most individuals will experience improvement or relief of symptoms with conservative treatment, the vast majority of TMD patients should receive initial management using noninvasive and reversible therapies.
- The efficacy of most treatment approaches for TMD is unknown, because most have not been adequately evaluated in long-term studies and virtually none in randomized controlled group trials. Although clinical observation can provide direction, these insights must be followed by rigorous scientific evaluation.
- There are no data to support some commonly held beliefs. For example, evidence is insufficient to warrant prophylactic modalities of therapy. Additionally, available data are not persuasive that orthodontic treatment prevents, predisposes to, or causes TMD. Therapies that permanently alter the patient's occlusion cannot be recommended on the basis of current data.
- Although noninvasive therapies are clearly preferred for most TMD problems, in the small percentage of patients with persistent and significant pain and dysfunction who show evidence of pathology or that an internal derangement of the TMJ is the source of their pain and dysfunction, and for whom more conservative treatment has failed, surgical intervention should be considered.

- The most promising approaches to management and treatment of patients with persistent TMD pain and dysfunction may result from evidence-based practice and patient-centered care. Relaxation and cognitive behavioral therapies are effective approaches to managing chronic pain. Physical therapy approaches need to be scientifically evaluated, as do alternative medicine modalities.
- Future advances in diagnosis and treatment of TMD will occur as the result of multidisciplinary collaborations among a number of fields involving basic and applied science and practice.
- Professional education is needed to ensure proper and safe practice in the treatment of TMD, especially with regard to pharmacological, surgical, and behavioral approaches. Moreover, if patients are to know where to seek help, and if insurance companies are to fully acknowledge the need for treatment of TMD, a consensus must be developed regarding the professional expertise needed to diagnose and treat these serious health problems.

Technology Assessment Panel

Judith E. N. Albino, Ph.D.
*Panel Chairperson
President Emerita and Professor
of Psychiatry
University of Colorado Health
Sciences Center
Denver, Colorado*

James D. Beck, Ph.D.
*Kenan Professor and Chair
Department of Dental Ecology
School of Dentistry
University of North Carolina
at Chapel Hill
Chapel Hill, North Carolina*

Karen J. Berkley, Ph.D.
*McKenzie Professor
Program in Neuroscience
Department of Psychology
Florida State University
Tallahassee, Florida*

James N. Campbell, M.D.
*Professor of Neurosurgery
School of Medicine
Johns Hopkins Hospital
Baltimore, Maryland*

Joel Edelman, J.D.
*Executive Vice President
and Founder
Frontier Community Health
Plans, Inc.
Englewood, Colorado*

Edgar Haber, M.D.
*Elkan R. Blout Professor
of Biological Sciences
Director, Division of Biological
Sciences
Harvard School of Public Health
Boston, Massachusetts*

Donna L. Hammond, Ph.D.
*Associate Professor of Anesthesia
and Critical Care and the
Committee on Neurobiology
Department of Anesthesia
and Critical Care
University of Chicago
Chicago, Illinois*

Marjorie Jeffcoat, D.M.D.
*Rosen Professor and Chair
Department of Periodontics
School of Dentistry
University of Alabama
at Birmingham
Birmingham, Alabama*

Thomas S. Jeter, D.D.S., M.D.
*Oral and Maxillofacial Surgeon
Private Practice
San Angelo, Texas*

Sonja M. McKinlay, Ph.D.
*President
New England Research Institutes
Watertown, Massachusetts*

Elizabeth J. Narcessian, M.D.
*Clinical Chief
Pain Management Program
Kessler Institute for
Rehabilitation, Inc.
East Orange, New Jersey
Assistant Professor of Physical
Medicine and Rehabilitation
New Jersey Medical School
Newark, New Jersey*

Buddy D. Ratner, Ph.D.
*Professor
Center for Bioengineering
University of Washington
Seattle, Washington*

E. Dianne Rekow, D.D.S., Ph.D.
*Professor and Chair
Department of Orthodontics
New Jersey Dental School
University of Medicine and
Dentistry of New Jersey
Newark, New Jersey*

Lisa A. Tedesco, Ph.D.
*Professor and Associate Dean for
Academic Affairs
School of Dentistry
University of Michigan
Ann Arbor, Michigan*

Stephen B. Towns, D.D.S.
*President
National Dental Association
Chicago, Illinois*

Speakers

Michael C. Alpern, D.D.S., M.S.
“The Role of Arthroscopy
in the Treatment of
Temporomandibular Disorders”
*Adjunct Professor of Orthodontics
School of Dentistry
Marquette University
Port Charlotte, Florida*

Glenn T. Clark, D.D.S.
“Modern Concepts of Occlusal
Disease and the Efficacy of
Occlusal Therapy”
*Professor and Chair
Department of Diagnostic
Science and Orofacial Pain
School of Dentistry
University of California,
Los Angeles
Los Angeles, California*

Barry C. Cooper, D.D.S.
“The Role of Bioelectronic
Instrumentation in the
Documentation and
Management of
Temporomandibular Disorders”
*International President
International College of
Cranio-Mandibular Orthopedics
Lawrence, New York*

Lambert G.M. de Bont, D.D.S., Ph.D.
“Epidemiology and Natural Pro-
gression of Temporomandibular
Joint Intracapsular and
Arthritic Conditions”
*Professor and Chairman
Department of Oral and
Maxillofacial Surgery
Groningen University Hospital
Groningen, The Netherlands*

Raymond A. Dionne, D.D.S., Ph.D.
“Pharmacologic Modalities”
*Chief, Clinical Pharmacology Unit
Neurobiology and Anesthesiology
Branch
Division of Intramural Research
National Institute of Dental Research
National Institutes of Health
Bethesda, Maryland*

M. Franklin Dolwick, D.M.D., Ph.D.
“Temporomandibular Joint Surgery
for Internal Derangement”
*Professor and Director of
Residency Programs
Department of Oral
Maxillofacial Surgery
College of Dentistry
University of Florida
Gainesville, Florida*

Samuel F. Dworkin, D.D.S., Ph.D.
“Behavioral and Educational
Modalities”
*Professor
Departments of Oral Medicine,
Psychiatry, and Behavioral
Sciences
Orofacial Pain Research Group
Schools of Dentistry and Medicine
University of Washington
Seattle, Washington*

**Jocelyne S. Feine, D.D.S., M.S.,
H.D.R.**
“Physical Therapy: A Critique”
*Associate Professor
Faculty of Dentistry
McGill University
Montreal, Quebec
Canada*

**Kenneth M. Hargreaves, D.D.S.,
Ph.D.**
"Neuroendocrine and Immune
Considerations"
*Associate Professor
Division of Endodontics
Department of Restorative Sciences
School of Dentistry
University of Minnesota
Minneapolis, Minnesota*

Pentti Kirveskari, D.D.S., Ph.D.
"Occlusal Adjustment"
*Associate Professor
Institute of Dentistry
University of Turku
Turku, Finland*

Linda LeResche, Sc.D.
"Assessing Physical and Behavioral
Outcomes of Treatment"
*Research Associate Professor
Department of Oral Medicine
Orofacial Pain Research Group
School of Dentistry
University of Washington
Seattle, Washington*

Frank P. Luyten, M.D., Ph.D.
"A Scientific Basis for the Biological
Regeneration of Synovial Joints"
*Project Leader
Developmental Biology Program
Bone Research Branch
National Institute of Dental Research
National Institutes of Health
Bethesda, Maryland*

Joseph J. Marbach, D.D.S.
"Future Directions for Advancing
Treatment of Chronic Musculo-
skeletal Facial Pain"
*Robert and Susan Carmel Professor
in Algesiology
Department of Oral Pathology,
Biology, and Diagnostic Sciences
and Department of Psychiatry
University of Medicine and
Dentistry of New Jersey
Newark, New Jersey*

James A. McNamara, D.D.S., Ph.D.
"Orthodontic Treatment and
Temporomandibular Disorders"
*Professor and Research Scientist
Department of Orthodontics and
Pediatric Dentistry and Center for
Human Growth and Development
University of Michigan
Ann Arbor, Michigan*

Charles McNeill, D.D.S.
"History and Evolution of Tempo-
mandibular Disorder Concepts"
*Clinical Professor
Director, Center for TMD and
Orofacial Pain
Department of Restorative Dentistry
School of Dentistry
University of California,
San Francisco
San Francisco, California*

Stephen B. Milam, D.D.S., Ph.D.
"Failed Implants and Multiple
Operations"
Associate Professor
Division of Oral and Maxillofacial
Surgery
Department of Surgery
Medical School
University of Texas Health Science
Center at San Antonio
San Antonio, Texas

Gerald J. Murphy, D.D.S.
"Physical Medicine Modalities
and Trigger Point Injections
in the Management of
Temporomandibular Disorders"
President
American Academy of Head, Neck,
and Facial Pain
Grand Island, Nebraska

Jeffrey P. Okeson, D.M.D.
"Current Terminology and Diagnostic
Classification Schema"
Professor, Department of Oral
Health Practice
Director, Orofacial Pain Center
College of Dentistry
University of Kentucky
Lexington, Kentucky

**Christian S. Stohler, D.D.S., Ph.D.,
D.M.D.**
"Epidemiology and Natural
Progression of Muscular
Temporomandibular Disorder
Conditions"
Professor and Chair
Department of Biologic and
Materials Sciences and Center
for Human Growth and
Development
School of Dentistry
University of Michigan
Ann Arbor, Michigan

Dennis C. Turk, Ph.D.
"Psychosocial and Behavioral
Assessment of Temporomandibular
Disorder Patients"
Director, Pain Evaluation and
Treatment Institute
University of Pittsburgh
Medical Center
Professor of Psychiatry,
Anesthesiology, and Behavioral
Science
University of Pittsburgh
School of Medicine
Pittsburgh, Pennsylvania

Joseph P. Vacanti, M.D.
"Tissue Engineering"
Associate Professor of Surgery
Director of Organ Transplantation
Department of Surgery
Harvard Medical School
Children's Hospital
Boston, Massachusetts

Michael R. Von Korff, Sc.D.
"Health Care Services
Issues Concerning
Temporomandibular Disorders"
Scientific Investigator
Center for Health Studies
Group Health Cooperative of
Puget Sound
Seattle, Washington

Larry M. Wolford, D.D.S.
"Temporomandibular Joint Devices:
Treatment Factors and Outcomes"
Clinical Professor
Department of Oral and
Maxillofacial Surgery
Baylor College of Dentistry
Baylor University Medical Center
Dallas, Texas

Planning Committee

Judith E. N. Albino, Ph.D.
*Panel Chairperson
President Emerita and Professor
of Psychiatry
University of Colorado Health
Sciences Center
Denver, Colorado*

Patricia S. Bryant, Ph.D.
*Director
Behavior, Pain, Oral Function, and
Epidemiology Program
Division of Extramural Research
National Institute of Dental Research
National Institutes of Health
Bethesda, Maryland*

Elaine Collier, M.D.
*Chief, Autoimmunity Section
Division of Allergy, Immunology
and Transplantation
National Institute of Allergy and
Infectious Diseases
National Institutes of Health
Bethesda, Maryland*

Raymond A. Dionne, D.D.S., Ph.D.
*Chief, Clinical Pharmacology Unit
Neurobiology and Anesthesiology
Branch
Division of Intramural Research
National Institute of Dental Research
National Institutes of Health
Bethesda, Maryland*

Jerry M. Elliott
*Program Analyst
Office of Medical Applications
of Research
National Institutes of Health
Bethesda, Maryland*

John H. Ferguson, M.D.
*Director
Office of Medical Applications
of Research
National Institutes of Health
Bethesda, Maryland*

William H. Hall
*Director of Communications
Office of Medical Applications
of Research
National Institutes of Health
Bethesda, Maryland*

Stephen P. Heyse, M.D., M.P.H.
*Director
Office of Prevention, Epidemiology
and Clinical Applications
National Institute of Arthritis and
Musculoskeletal and Skin Diseases
National Institutes of Health
Bethesda, Maryland*

Cheryl A. Kitt, Ph.D.
*Health Scientist Administrator
Division of Demyelinating, Atrophic,
and Dementing Disorders
National Institute of Neurological
Disorders and Stroke
National Institutes of Health
Bethesda, Maryland*

James A. Lipton, D.D.S., Ph.D.
*Special Assistant for Training
and Career Development
National Institute of Dental Research
National Institutes of Health
Bethesda, Maryland*

Mary D. Lucas Leveck, Ph.D., R.N.
*Scientific Program Administrator
Division of Extramural Programs
National Institute of Nursing
Research
National Institutes of Health
Bethesda, Maryland*

William Maas, D.D.S.
*Chief Dental Officer
Agency for Health Care Policy
and Research
Rockville, Maryland*

Stephen B. Milam, D.D.S., Ph.D.
*Associate Professor
Division of Oral and
Maxillofacial Surgery
Department of Surgery
Medical School
University of Texas Health Science
Center at San Antonio
San Antonio, Texas*

Jeffrey P. Okeson, D.M.D.
*Professor, Department of Oral
Health Practice
Director, Orofacial Pain Center
College of Dentistry
University of Kentucky
Lexington, Kentucky*

Joyce Rudick
*Senior Program Analyst
Office of Research on Women's Health
Office of the Director
National Institutes of Health
Bethesda, Maryland*

Patricia G. Sheridan
*Technical Writer/Editor
Public Information and
Reports Branch
National Institute of Dental Research
National Institutes of Health
Bethesda, Maryland*

**Christian S. Stohler, D.D.S., Ph.D.,
D.M.D.**
*Professor and Chair
Department of Biologic and
Materials Sciences and Center
for Human Growth and
Development
School of Dentistry
University of Michigan
Ann Arbor, Michigan*

Carolyn A. Tylenda, D.M.D, Ph.D.
*Dental Officer
Dental Devices Branch
Center for Devices and
Radiological Health
Food and Drug Administration
Rockville, Maryland*

John T. Watson, Ph.D.
*Head
Bioengineering Research Group
Division of Heart and
Vascular Diseases
National Heart, Lung, and
Blood Institute
National Institutes of Health
Bethesda, Maryland*

Susan S. Wise
*Program Analyst
Office of Planning, Evaluation,
and Communications
National Institute of Dental Research
National Institutes of Health
Bethesda, Maryland*

Conference Sponsors

**National Institute of
Dental Research**
Harold C. Slavkin, D.D.S.
Director

**Office of Medical Applications
of Research, NIH**
John H. Ferguson, M.D.
Director

Conference Cosponsors

**National Institute of Arthritis
and Musculoskeletal and
Skin Diseases**
Stephen I. Katz, M.D., Ph.D.
Director

**National Institute of
Neurological Disorders
and Stroke**
Zach W. Hall, Ph.D.
Director

**National Institute of
Nursing Research**
Patricia A. Grady, R.N., Ph.D.
Director

**Office of Research on Women's
Health, NIH**
Vivian W. Pinn, M.D.
Director

Bibliography

The following references were provided by the speakers listed above and were neither reviewed nor approved by the panel.

- Alanen P, Kirveskari P. Disorders in TMJ research. *J Craniomandib Disord* 1990;4:223–7.
- Alpern MC. TMJ biocompatible orthodontic treatment. *Angle Orthod* 1992.
- Alpern MC, Nuelle DG, Wharton MC. TMJ diagnosis and treatment in a multidisciplinary environment—follow-up study. *Angle Orthod* 1988.
- Brittberg M, Lindahl A, Nilsson A, Ohlson C, Isaksson O, Peterson L. Treatment of deep cartilage defects in the knee with autologous chondrocyte transplantation. *N Engl J Med* 1994;331:889–95.
- Brown DT, Gaudet EL. Outcome measurement for treated and untreated TMD patients using the TMJ scale. *J Craniomandib Pract* 1994;4:216–21.
- Chang S, Hoang B, Thomas JT, Vukicevic S, Luyten FP, Ryba N, Kozak CA, Reddi AH, Moos M. Cartilage-derived morphogenetic proteins: new members of the TGF- β superfamily, predominantly expressed in long bones during human embryonic development. *J Biol Chem* 1994;269:28227–34.
- Cooper BC. Craniomandibular disorders, in management of facial head and neck pain. In: Cooper BC, Lucente FE, eds. Philadelphia: WB Saunders, 1989. p. 153–254.
- Cooper BC. The role of bioelectronic instruments in the management of TMD. *NY State Dent J* 1995;Nov:48–53.
- Cooper B, Cooper D, Lucente F. Electromyography of masticatory muscles in craniomandibular disorders. *Laryngoscope* 1991;101(2):150–7.
- De Kanter RJ, Truin GJ, Burgersdijk RCW, Van't Hof MA, Battistuzzi PG, Kalsbeek H, Kayser AF. Prevalence in the Dutch population and a meta-analysis of signs and symptoms of temporomandibular disorders. *J Dent Res* 1993;72:1509–18.
- DeRouen TA. Statistical and methodological issues in temporomandibular disorders. In: Sessle BJ, Bryant PS, Dionne RA, eds. Temporomandibular disorders and related pain conditions. Seattle: IASP Press, 1995. p. 459–65.
- Deyo RA, Walsh NE, Martin DC, et al. A controlled trial of transcutaneous electrical nerve stimulation (TENS) and exercise for chronic low back pain. *N Engl J Med* 1990;322:1627–34.

- Dibbets JHM, van der Weele LT. Long-term effects of orthodontic treatment, including extractions, on signs and symptoms attributed to CM D. *Eur J Orthod* 1992;14:16–20.
- Dolwick MF, Nitzan DW. The role of disc-repositioning surgery for internal derangement of the temporomandibular joint. *Oral Maxillofacial Surg Clin NA* 1994;6:271–5.
- Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: Review, criteria, examinations and specifications, critique. *J Craniomandib Disord* 1992;6(4):301–55.
- Dworkin SF, LeResche L, eds. Research diagnostic criteria for temporomandibular disorders. Review, criteria, examinations and specifications, critique. *J Craniomandib Disord* 1992;7:701–77.
- Dworkin SF, LeResche L, eds. Research diagnostic criteria for temporomandibular disorders. Review, criteria, examinations and specifications, critique. Chicago: Quintessence Publishing Co., 1993.
- Dworkin SF, et al. Epidemiology of signs and symptoms in temporomandibular disorders: Clinical signs in cases and controls. *J Am Dent Assoc* 1990; 120:273–81.
- Ericksson L, Westesson P-L. Long-term evaluation of meniscectomy of the temporomandibular joint. *J Oral Maxillofacial Surg* 1985;43:263–9.
- Forsell H, Kirveskari P, Kangasniemi P. Changes in headache after treatment of mandibular dysfunction. *Cephalalgia* 1985;5:229–36.
- Goulet JP, Lavigne GJ, Lund JP. Jaw pain prevalence among French-speaking Canadians in Québec and related symptoms of temporomandibular disorders. *J Dent Res* 1995;74:1738–44.
- Guyatt GH, Rennie D. Users' guides to the medical literature. *JAMA* 1993; 270:2096–7.
- Guyatt GH, Sackett DL, Cook DJ. Users' guides to the medical literature II. How to use an article about therapy or prevention. A. Are the results of the study valid? *JAMA* 1993;270:2598–601.
- Henry CH, Wolford LM. Treatment outcomes of temporomandibular joint reconstruction after proplast-teflon implant failure. *J Oral Maxillofacial Surg* 1993;51:352–8.

- Hickman D, Cramer R, Stauber W. The effect of four jaw relations on electromyographic activity in human masticatory muscles. *Arch Oral Biol* 1993;38(3):261-4.
- Huggins KH, Dworkin SF, LeResche L, Truelove E. Five-year course for temporomandibular disorders using RDC/TMD. *J Dent Res* (Special Issue) 1996;75:352 (Abstract).
- Jadad AR. Systematic reviews and meta-analysis in pain relief research: What can (and cannot) they do for us? In: Campbell JN, ed. *Pain 1996—An updated review*. Seattle: IASP Press, 1996. p. 445-52.
- Jensen MP, Karoly P. Self-report scales and procedures for assessing pain in adults. In: Turk DC, Melzack R, eds. *Handbook of pain assessment*. New York: Guilford Press, 1992. p. 135-51.
- Kinney RK, Gatchel RJ, Ellis E, Holt C. Major psychological disorders in chronic TMD patients: Implications for successful management. *J Am Dent Assoc* 1992;127:77-9.
- Kirveskari P, Alanen P. Odds ratio in the estimation of the significance of occlusal factors in craniomandibular disorders. *J Oral Rehabil* 1995;22:581-4.
- Kirveskari P, Alanen P, Jämsä T. Association between craniomandibular disorders and occlusal interferences in children. *J Prosthet Dent* 1992; 67:692-6.
- Koes BW, Bouter LM, van Mameren H, et al. The effectiveness of manual therapy, physiotherapy, and treatment by the general practitioner for non-specific back and neck complaints: A randomized clinical trial. *Spine* 1992;17:28-35.
- Kremenak CR, Kinser DD, Harman HA, Menard CC, Jakobsen JR. Orthodontic risk factors for temporomandibular disorders (TMD). *Am J Orthod Dentofacial Orthop* 1992;101:13-20, 21-7.
- Luyten FP. Cartilage-derived morphogenetic proteins: Key regulators in chondrocyte differentiation? *Acta Orthop Scand* 1995;66:51-4.
- Malone MD, Strube MJ. Meta-analysis of non-medical treatments for chronic pain. *Pain* 1988;34:231-44.
- Manniche C, Hesselsoe G, Bentzen L, Christensen I, Lundberg E. Clinical trial of intensive muscle training for chronic low back pain. *Lancet* 1988; 2:1473-6.

- Marbach JJ, Raphael KG. Treatment of orofacial pain using evidence-based medicine: the case for intraoral appliances. In: Campbell JN, ed. Pain 1996—An updated review: refresher course syllabus. Seattle: IASP Press, 1996.
- McCain JP, Sanders B, Koslin MG, et al. Temporomandibular joint arthroscopy: A six year multicenter retrospective study of 4,831 joints. *J Oral Maxillofacial Surg* 1992;50:926–30.
- McNamara JA Jr, Seligman DA, Okeson JP. Occlusion, orthodontic treatment and temporomandibular disorders: A review. *J Orofacial Pain* 1995;9:73–90.
- McNeill C, ed. Temporomandibular disorders—guidelines for classification, assessment, and management. Chicago: Quintessence Publishing Co., 1993.
- Mohl ND, Lund JP, Widmer CG, McCall WD Jr. Devices for the diagnosis and treatment of temporomandibular disorders. Part II: Electromyography and sonography. *J Prosthet Dent* 1990;63:332–5.
- Mohl ND, McCall WD Jr, Lund JP, Plesh O. Devices for the diagnosis and treatment of temporomandibular disorders. Part I: Introduction, scientific evidence, and jaw tracking. *J Prosthet Dent* 1990;63:198–201.
- Mohl ND, Ohrbach RK, Crow HC, Gross AJ. Devices for the diagnosis and treatment of temporomandibular disorders. Part III: Thermography, ultrasound, electrical stimulation, and electromyographic biofeedback. *J Prosthet Dent* 1990;63:472–6.
- Nickerson JW, Veaco NS. Condylotomy in surgery of the temporomandibular joint. *Oral Maxillofacial Surg Clin NA* 1989;1:303–27.
- NIH Technology Assessment Conference. Integration of behavioral and relaxation approaches into the treatment of chronic pain and insomnia; 1995 Oct 16–18; Bethesda, Maryland. Program and Abstracts. Bethesda: National Institutes of Health, 1995. 104 p.
- Nitzan DW. Arthrocentesis for management of severe closed lock of the temporomandibular joint. *Oral Maxillofacial Surg Clin NA* 1994;6:245–57.
- Nuelle DG, Alpern MC. Operative arthroscopy (3 chapters). New York: Lippincott-Raven Publishers, 1991. p. 753–83.
- Nuelle DG, Alpern MC. Operative arthroscopy (3 chapters). New York: Lippincott-Raven Publishers, 1996. p. 1173–93.
- Okeson J. Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. *Cephalalgia* 1988;8(Suppl 7):1–97.

- Okeson J, ed. *Orofacial pain: Guidelines for classification, assessment, and management*. 3rd ed. Chicago: Quintessence Publishing Co., 1996.
- Pullinger AG, Seligman DA, Gornbein JA. A multiple regression analysis of the risk and relative odds of temporomandibular disorders as a function of common occlusal features. *J Dent Res* 1993;72:968–79.
- Rudy TE, Turk DC, Kubinski JA, Zaki-Hussein S. Differential treatment responses of TMD patients as a function of psychological characteristics. *Pain* 1995;6:107–12.
- Rudy TE, Turk DC, Zaki HS, Curtin HD. An empirical taxometric alternative to traditional classification of temporomandibular disorders. *Pain* 1989;36:311–20.
- Salonen L, Hellden L, Carlsson GE. Oral health status in an adult Swedish population. Prevalence of signs and symptoms of dysfunction in the masticatory system. *Swed Dent J Suppl* 1990;70:1–22.
- Salonen L, Helldén L, Carlsson GE. Prevalence of signs and symptoms of dysfunction in the masticatory system: An epidemiologic study in an adult Swedish population. *J Craniomandib Disord* 1990;4:241–50.
- Sessle BJ, Bryant PS, Dionne RN, eds. *TMD and related pain conditions*. In: Fields HL, ed. *Progress in pain research*. Vol. 4. Seattle: IASP Press, 1995.
- Simmons HC, Gibbs SJ. Recapture of temporomandibular disks using anterior repositioning appliances. *J Craniomandib Pract* 1995;4:228–37.
- Stegenga B, de Bont LGM, Boering G. Osteoarthritis as the cause of craniomandibular pain and dysfunction: A unifying concept. *J Oral Maxillofacial Surg* 1989;47:249–56.
- Thomas NR. The effect of fatigue and TENS on the EMG mean power frequency. In: Bergamini M, ed. *Pathophysiology of head and neck musculo-skeletal disorders*. Front oral physiology. Vol. 7. Basel: Karger, 1990. p. 162–70.
- Thomas JT, Lin K, Nandedkar M, McBride W, Camargo M, Cervenka J, Luyten FP. A human chondrodysplasia due to a mutation in a TGF- β superfamily member. *Nature Genet* 1996;12:315–7.
- Truelove EL, Sommers EE, LeResche L, Dworkin SF, Von Korff M. Clinical diagnostic criteria for TMD. New classification permits multiple diagnoses [see comments]. *J Am Dent Assoc* 1992;123(4):47–54. (Comment in: *J Am Dent Assoc* 1992 Oct;123(10):12.)

- Turk DC, Rudy TE. Toward an empirically derived taxonomy of chronic pain patients: Integration of psychological assessment data. *J Consult Clin Psychol* 1988;56:233–8.
- Turk DC, Rudy TE, Zaki HS. Multiaxial assessment and classification of TMD pain patients: Implications for treatment. In: Friction JR, Dubner R, eds. *Advances in pain research and therapy: Orofacial and temporomandibular disorders*. New York: Raven Press, 1996. p. 145–64.
- Van Loon JP, DeBont LGM, Boering G. Evaluation of temporomandibular joint prostheses: Review of the literature from 1946 to 1994 and implications for future prosthesis designs. *J Oral Maxillofacial Surg* 1995;53:984–97.
- Von Korff M. Health services research and temporomandibular pain. In: Sessle BJ, Bryant PS, Dionne RA, eds. *Temporomandibular disorders and related pain conditions, progress in pain research and management*. Vol. 4. Seattle: IASP Press, 1995.
- Von Korff M, Dworkin SF, LeResche L, Kruger A. An epidemiologic comparison of pain complaints. *Pain* 1988;32:173–83.
- Von Korff M, Howard JA, Truelove EL, Wagner E, Dworkin S. Temporomandibular disorders: Variation in clinical practice. *Med Care* 1988;26:307–14.
- Von Korff M, Wagner EH, Dworkin SF, Saunders KW. Chronic pain and use of ambulatory health care. *Psychosom Med* 1991;53:61–79.
- Wennberg JE. Dealing with medical practice variations: A proposal for action. *Health Aff* 1984;3:6–13.
- Wexler GB, McKinney MW. Assessing treatment outcomes in two TMD diagnostic categories employing a validated psychometric test. *J Craniomandib Pract* 1995;4:256–63.
- Widmer CG. Physical characteristics associated with temporomandibular disorders. In: Sessle BJ, Bryant PS, Dionne RA, eds. *Temporomandibular disorders and related pain conditions*. Seattle: IASP Press, 1995. p. 161–74.
- Widmer CG, Lund JP, Feine JS. Evaluation of diagnostic tests for TMD. *CDA J* 1990;18:53–60.
- Willis WA. Excessive cuspid rise with a tight vertical element—a new effective splint design for TMD. *Am J Orthod Dentofacial Orthop* 1995;3:229–34.
- Wolford LM, Cottrell DA, Henry CH. Temporomandibular joint reconstruction of the complex patient with the techmedica custom-made total joint prosthesis. *J Oral Maxillofacial Surg* 1994;52:2–10.

Wolford LM, Henry CH, Nikaein A, Newman JT, Namey TC. The temporomandibular joint alloplastic implant problem. In: Sessle BJ, Bryant PS, Dionne RA, eds. Progress in pain research and management. Seattle: IASP Press, 1995.

Management of Temporomandibular Disorders

A Continuing Education Activity Sponsored by the National Institutes of Health

OBJECTIVE

The objective of this NIH Technology Assessment Statement is to inform the biomedical research and clinical practice communities of the results of the NIH Technology Assessment Conference on Management of Temporomandibular Disorders. The statement provides state-of-the-art information regarding the diagnosis, treatment, and management of temporomandibular disorders, and presents the conclusions and recommendations of the technology assessment panel regarding these issues. In addition, the statement identifies those areas of study that deserve further investigation. Upon completing this educational activity, the reader should possess a clear working clinical knowledge of the state-of-the-art regarding this topic.

ACCREDITATION

For Physicians

The National Institutes of Health is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians. The National Institutes of Health designates this continuing medical education activity for 1 credit hour in Category I of the Physician's Recognition Award of the American Medical Association. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

For Dentists

The National Institute of Dental Research is an ADA CERP-recognized provider #09896006. This continuing dental education activity has been certified for 1 credit hour.

EXPIRATION

This form must be completed and **postmarked by April 30, 1998**, for eligibility to receive continuing education credit for this continuing education activity. The expiration date for this test may be extended beyond April 30, 1998. Beginning May 1, 1998, please check the NIH Consensus Development Program web site (<http://consensus.nih.gov>) or call the NIH Office of Medical Applications of Research at 301-496-1144 for information regarding an extended expiration date for this continuing medical education activity.

INSTRUCTIONS: The Technology Assessment Statement contains the correct answers to the following 15 questions. Select your answer(s) to each question and write the corresponding letter(s) in the answer space provided. Mail the completed test by the expiration date shown above to *CME Program, Office of Medical Applications of Research, National Institutes of Health, Federal Building, Room 618, 7550 Wisconsin Avenue MSC 9120, Bethesda, MD 20892-9120*. You will receive notification of your test results within 2 to 3 weeks. If you have successfully completed the test (11 or more correct answers), you will receive a certificate for 1 hour of continuing education credit along with your test results. Photocopies of this form are acceptable. There is no fee for participating in this continuing education activity.



National Institutes Of Health

Continuing Medical Education

1. The clinical conditions usually classified as TMD include those with: (*You must indicate all that are true.*)
- a) pain or dysfunction in the temporomandibular joint (TMJ)
 - b) pain or dysfunction in the structures contiguous to the TMJ
 - c) dryness of the mouth
 - d) all of the above

ANSWER: _____

2. Which one of the following statements is FALSE:
- a) Generally accepted, scientifically based guidelines for the diagnosis and management of TMD are available.
 - b) As a group, TMD conditions have no common etiology or biological explanation, although specific etiologies such as degenerative arthritis and trauma underlie some types of TMD.
 - c) TMD conditions comprise a heterogeneous group of health problems whose signs and symptoms are overlapping, but not necessarily identical.
 - d) Current diagnostic classifications of most types of TMD are based on signs and symptoms rather than etiology.

ANSWER: _____

3. Available population-based epidemiologic data indicate that the prevalence of self-reported TMD signs and symptoms is:
- a) less than 5 percent
 - b) between 5 and 15 percent
 - c) between 15 and 25 percent
 - d) between 25 and 30 percent

ANSWER: _____

4. Peak prevalence of TMD occurs in individuals
- a) less than 20 years of age
 - b) 20 to 40 years of age
 - c) 40 to 50 years of age
 - d) roughly equal prevalence in all age groups

ANSWER: _____

5. In clinical case series studies of TMD patients with no detectable organic etiology, in which conservative, reversible, noninvasive therapy was emphasized, the presenting signs and symptoms appeared to:
- a) improve in the vast majority of patients
 - b) persist or recur in most patients
 - c) worsen in the majority of patients
 - d) remain the same in most patients

ANSWER: _____

6. Which of the following statements clearly is supported by data from controlled, randomized studies:
- a) Orthodontic treatment prevents TMD
 - b) Orthodontic treatment predisposes to TMD
 - c) Orthodontic treatment causes TMD
 - d) All of the above
 - e) None of the above

ANSWER: _____

7. Initial management of TMD patients should be based on information that includes all of the following EXCEPT:
- a) presence of tenderness in the jaw joint or contiguous muscles
 - b) existence of parafunctional conditions, such as clenching or grinding the teeth
 - c) the patient's perception of pain and dysfunction and the impact of these on the patient's quality of life
 - d) analysis of periodontal pathology or salivary flow

ANSWER: _____

8. Initial management of TMD patients without underlying systemic or overt TMJ pathology could include all of the following EXCEPT:
- a) patient education on what is known about TMD
 - b) procedures directed at eliminating certain behaviors perceived to be harmful, such as clenching and grinding the teeth
 - c) extensive restorative dental procedures
 - d) medications similar to those useful for other painful musculoskeletal conditions

ANSWER: _____

9. Which of the following are considered conservative, noninvasive, and reversible approaches that generally are useful for the initial management of TMD patients: (You must indicate all that are true.)
- a) physical therapy
 - b) stabilization splints
 - c) occlusal therapies

ANSWER: _____

10. The preferred pharmacologic agents for initial symptom management of most TMD patients, at a dosage commensurate with the level of pain, include: (You must indicate all that are true.)
- a) nonsteroidal anti-inflammatory drugs (NSAIDs)
 - b) muscle relaxant medications and sedating low-dose antidepressants
 - c) opiates

ANSWER: _____

11. Occlusal therapy, which permanently alters an extensive amount of a patient's tooth structure and the individual's occlusion, is irreversible. Since the superiority of this treatment over reversible therapies has not been demonstrated in randomized controlled prospective trials, this form of occlusal adjustment probably will not represent best practice for initial management of TMD.
- a) True
 - b) False

ANSWER: _____

12. Given the lack of evidence about the demonstrated effectiveness in randomized controlled clinical trials of any single treatment or combination of procedures for the management of patients with *persistent* TMD pain and dysfunction, there is no consensus about specific treatment recommendations that can be made at this time.
- a) True
 - b) False

ANSWER: _____

13. Data from randomized controlled studies are available that show the consistent effectiveness of relaxation and cognitive behavioral therapies in the management of pain associated with TMD.
- a) True
 - b) False

ANSWER: _____

14. Which groups of drugs can be considered for patients with persistent TMD pain and dysfunction who respond poorly to or are unable to tolerate NSAIDs and opiates? (You must indicate all that are true.)

- a) tricyclic antidepressants
- b) anticonvulsants
- c) sympatholytic agents
- d) all of the above

ANSWER: _____

15. All of the following statements are true EXCEPT:

- a) The most promising approaches to management and treatment of patients with persistent TMD pain and dysfunction may result from evidence-based practice and patient-centered care.
- b) Surgical intervention may be appropriate in a small percentage of TMD patients who have persistent and significant pain and dysfunction, who show evidence of correctable organic TMJ pathology, and for whom more conservative treatment has failed.
- c) The efficacy of most treatment approaches for TMD is unknown because most have not been adequately evaluated in long-term studies and virtually none in randomized controlled group trials.
- d) There is consensus across the dental and medical communities regarding which TMD problems should be treated and how they should be managed.

ANSWER: _____

Your answer to the following two questions is optional and will have no effect on the grading results of this test.

Was the objective of this continuing education activity clearly stated?

- a) not at all
- b) very little
- c) somewhat
- d) considerably
- e) completely

ANSWER: _____

Did the activity planners provide the necessary information to meet the stated goals and objectives?

- a) not at all
- b) very little
- c) somewhat
- d) considerably
- e) completely

ANSWER: _____

Please choose the type of accreditation you wish to receive (check only one box):

- American Medical Association (For Physicians)
- American Dental Association (For Dentists)

NAME (Please type or print clearly)

TITLE

ADDRESS

CITY STATE ZIP

PHONE FAX

Please mail test to: CME Program
Office of Medical Applications of Research
National Institutes of Health
Federal Building, Room 618
7550 Wisconsin Avenue MSC9120
Bethesda, MD 20892-9120



U.S. DEPARTMENT OF HEALTH
AND HUMAN SERVICES
Public Health Service
National Institutes of Health
Office of Medical Applications of Research
Federal Building, Room 618
7550 Wisconsin Avenue, MSC9120
Bethesda, MD 20892-9120

Official Business
Penalty for private use \$300

BULK RATE
Postage & Fees
PAID
DHHS/NIH
Permit No. G3802