Sponsored by

PracticeWorks, Inc.
KODAK 3D Extraoral Imaging System

www.kodakdental.com

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

JADA

Cost-effectiveness of treatments for temporomandibular disorders Biopsychosocial intervention versus treatment as usual

Anna Wright Stowell, Robert J. Gatchel and Lynn Wildenstein

J Am Dent Assoc 2007;138;202-208

The following resources related to this article are available online at jada.ada.org (this information is current as of March 3, 2009):

Updated information and services including high-resolution figures, can be found in the online version of this article at:
http://jada.ada.org/cgi/content/full/138/2/202

This article appears in the following **subject collections**:
Practice Management http://jada.ada.org/cgi/collection/practice_management

Information about obtaining **reprints** of this article or about permission to reproduce this article in whole or in part can be found at:
http://www.ada.org/prof/resources/pubs/jada/permissions.asp

Downloaded from jada.ada.org on March 3, 2009

© 2009 American Dental Association. The sponsor and its products are not endorsed by the ADA.

Cost–effectiveness of treatments for temporomandibular disorders

Biopsychosocial intervention versus treatment as usual

Anna Wright Stowell, PhD; Robert J. Gatchel, PhD; Lynn Wildenstein, MA

Temporomandibular disorders (TMDs), a group of disorders involving the muscles of the face, head, neck and temporomandibular joint,[1] are the second most commonly occurring musculoskeletal condition resulting in pain and disability (the first is chronic low back pain[2]).

TMD affects about 10 to 15 percent of the U.S. population,[3-5] with an annual cost estimated at $4 billion.[6] Only a minority of patients who seek treatment eventually progress to the stage of chronic TMD.[7] However, chronic TMD can lead to significant costs stemming from multiple treatments from a variety of health care providers and from lost wages.[8] For this reason, cost-effective early intervention is necessary to cut the enormous costs of this class of disorders, as well as to decrease unnecessary and prolonged suffering in patients with TMD.

Studies of patients with TMD have found that these disorders affect the social, vocational and emotional lives of patients; if TMD progresses to a chronic condition, it can become seriously debilitating and disruptive to everyday life.[1,9,10] When TMD becomes chronic, seeking treatment from clinicians who do not recognize the biopsychosocial aspects of these disorders can set up a revolving door, with the patient visiting provider after provider in the wake of treatment failures that can exacerbate the patient's distress.[8]

As the patient's pain increases without resolution, a domino effect takes place, consisting of increased pain duration, health care utilization, distress and, ultimately, costs. Few cost data are available for patients with TMD. However, Brotman[11] found that managed care treatment costs for TMD ranged from $12,000

ABSTRACT

Background. The authors conducted a randomized clinical trial to evaluate the cost-effectiveness of a biopsychosocial intervention with patients who are at high risk (HR) of progressing from acute to chronic TMD-related pain.

Methods. The authors classified 96 patients with acute TMD (less than six months' duration) as HR according to a predictive algorithm and randomized them into an early intervention (EI) or a nonintervention (NI) group. The NI group received a biopsychosocial treatment that included cognitive behavioral skills training and biofeedback. Both groups were followed up for one year. The authors collected TMD cost data throughout the year.

Results. The authors found that the EI group spent significantly fewer jaw-related health care dollars, relative to the NI group, from intake to the one-year follow-up.

Conclusion and Clinical Implications. The reduced jaw-related health care expenditures for patients in the EI group compared with expenditures for patients in the NI group at one year suggest that an early biopsychosocial intervention is a cost-effective measure in dealing with often unnecessarily costly TMD-related pain.

Key Words. Temporomandibular pain; health care costs; conservative treatment; early intervention.
JADA 2007;138(2):202-8.

Dr. Stowell is an assistant professor, departments of Anesthesiology and Pain Management, Psychiatry, and Rehabilitation Counseling, and the director of Behavioral Medicine Services at The Eugene McDermott Center for Pain Management, University of Texas Southwestern Medical Center at Dallas, 5323 Harry Hines Blvd., MC 9189, Dallas, Texas 75390–9189, e-mail "anna.stowell@utsouthwestern.edu". Address reprint requests to Dr. Stowell.
Dr. Gatchel is a professor and the chairman, Department of Psychology, College of Science, University of Texas at Arlington; a clinical professor, Department of Anesthesiology and Pain Management, and the clinical research director at The Eugene McDermott Center for Pain Management, University of Texas Southwestern Medical Center at Dallas.
The late Ms. Wildenstein was a research associate, Department of Psychology, College of Science, University of Texas at Arlington.

Downloaded from jada.ada.org on March 3, 2009

Copyright ©2007 American Dental Association. All rights reserved.

to $20,000 annually per patient. Moreover, studies have found that patients with TMD have significantly higher rates of utilization of health care services than do patients without TMD.[12-14]

For example, White and colleagues[12] studied 8,891 members of a health maintenance organization during a six-year period and found that patients with TMD used more of all types of services (not just TMD-related) than did control subjects in inpatient, outpatient and pharmaceutical groups. Similarly, Shimshak and colleagues[14] analyzed data from a Blue Cross/Blue Shield health plan and found that members who had submitted at least one health care claim for TMD had twice the rate of reimbursement for all medical claims compared with members who had no TMD claims. Furthermore, Shimshak and DeFuria[13] analyzed claims submitted to a New England health care insurer and found that members with one or more TMD claims used more health care services and had higher associated costs than did a comparison group with no TMD-related claims. In addition to incurring higher costs for health care services, patients with TMD use more sick leave than do patients without TMD.[15]

The costs of treatment for TMD are of particular concern because most insurance companies do not cover treatment associated with this diagnosis, and insurance laws regarding coverage vary by state.[16] Because of the multifactorial nature of these disorders, medical and dental insurance carriers typically pass the liability of TMD to each other, resulting in a situation in which both carriers refuse to pay. This leaves the patient fully responsible for what often is costly treatment.[17] Furthermore, as the above utilization figures indicate, if adequate treatment is not received, patients with TMD are likely to use more non-TMD medical services.

The purpose of our study was to analyze expenditures for patients with TMD who had received a biopsychosocial intervention in the acute phase of the disorder, relative to expenditures for those who did not receive this intervention. The effectiveness of the biopsychosocial intervention used in this study has been reported elsewhere.[6] Gatchel and colleagues[6] found that early intervention, using a standardized treatment protocol manual and based on a biopsychosocial approach (thus ensuring that all study subjects received the same treatment), was effective in reducing pain and decreasing the progression to chronic stages of TMD. Clearly, if the duration of pain decreases, so will the total associated costs. In a follow-up of patients in our earlier study, we aim to document the cost-effectiveness of this intervention.

SUBJECTS AND METHODS

Subjects. We obtained the subject cohort from a larger, ongoing study.[6] Of subjects in the larger study, now composed of 113 patients considered to be at high risk (HR) of developing acute jaw pain, 96 were included in this smaller study, because financial data were available for them. We randomly assigned the HR patients to early intervention (EI) and nonintervention (NI) groups. The final sample was composed of 76 women and 20 men; the mean age was 37.54 years, with a range of 18 to 60.88 years.

General dentists and oral surgeons in a major urban metropolitan area referred patients to the TMD Clinical Research Project at the University of Texas Southwestern Medical Center at Dallas, or patients responded to flyers and other advertising in the local media. Inclusion criteria for the study were that subjects had to be between the ages of 18 and 70 years and have acute jaw or facial pain (defined as present for less than six months). Two of us (A.W.S., L.W.) screened potential subjects and excluded them if they reported comorbid pain or exacerbating physical conditions, such as fibromyalgia, chronic low back pain or cancer, or if they had had any history of jaw pain before the current episode.

Methods. We conducted this cost analysis as an extension of our ongoing acute jaw pain study discussed above.[6,17] In summary, two of us (A.W.S., L.W.) followed up subjects with acute jaw pain from the initial intake through telephone follow-up calls every three months and a final follow-up visit at one year. During the initial intake and at the one-year follow-up visit, one of us (L.W.) interviewed subjects in person, and they completed a battery of psychosocial tests, underwent a jaw examination using the research diagnostic criteria,[6,17] and provided medical histories of their jaw pain and health care utilization. Psychosocial measures included the following: the

ABBREVIATION KEY. BDI-2: Beck Depression Inventory-2. **CPI:** Characteristic Pain Inventory. **EI:** Early intervention. **EOBs:** Explanations of benefits. **HR:** High risk. **LOCF:** Last-observation-carried-forward. **NI:** Nonintervention. **TMDs:** Temporomandibular disorders. **WOC:** Ways of Coping-Revised.

Copyright ©2007 American Dental Association. All rights reserved.

Downloaded from jada.ada.org on March 3, 2009

Characteristic Pain Inventory (CPI),[18] a pain intensity measure; the Beck Depression Inventory-2 (BDI-2),[19] a self-reported measure of depression; and the Ways of Coping-Revised (WOC),[20] a self-reported measure of coping that assesses five styles categorized into adaptive and maladaptive coping styles. A more complete description of these measures is provided elsewhere.[6]

We randomly assigned patients who were determined at intake to be at risk of progressing to chronic TMD to an EI or NI group. We made this determination using an algorithm that consisted of a two-variable predictive model (presence of a muscle disorder and characteristic pain intensity). A more complete description of this algorithm is found elsewhere.[21] Those assigned to the EI group participated in a module-driven biopsychosocial treatment that included cognitive-behavioral skills training and biofeedback, divided into six weekly sessions (a more comprehensive description of this treatment is provided in our earlier report[6]). We encouraged all subjects to receive any treatment "as usual" as prescribed by any outside health care providers with whom they had consulted or were continuing to consult. We intended study participation to be an adjunct to patients' ongoing care.

Cost data. We collected financial information at intake for the three-month period preceding the onset of pain and up to the intake appointment. Because we included subjects in the study only if their onset of pain occurred no longer than six months before the intake appointment, the financial information could have been for a period ranging from one day to nine months. We asked subjects to bring to the intake interview receipts and/or explanations of benefits (EOBs) for all expenditures for jaw treatment. We then asked subjects to maintain financial records of any jaw treatment received throughout the following year. In addition, subjects signed a medical release of information so that we could access information at one year even if subjects were unable to provide the data themselves.

At the three-, six- and nine-month follow-up contacts, we interviewed patients on the telephone regarding their current level of pain and their utilization of health care services. We asked them to differentiate between services used for the jaw and those used for other health issues. At the one-year follow-up visit, we asked subjects to bring receipts and/or EOBs for jaw treatment expenses incurred since their intake visit. For subjects who were unable to provide receipts for services, we used the medical release to obtain information from the treating health care professional.

EI group. We collected financial data only at the intake and one-year follow-up appointments. Within the EI group, we obtained financial data from 57 subjects at intake and 53 subjects at the one-year follow-up visit. Reasons for missing data at the one-year follow-up were as follows: one subject dropped out of treatment and we were unable to contact him at any follow-up time (that is, the three-, six- or nine-month contacts or the one-year visit); one subject completed treatment and the telephone contacts but we could not contact her for the one-year follow-up appointment; and two subjects had not reached the projected one-year follow-up visit by the time we wrote this report.

NI group. We obtained financial data from 39 subjects in the NI group at intake and from 37 subjects at the one-year follow-up visit. Reasons for missing data at the one-year follow-up were as follows: one subject had not reached the projected one-year follow-up visit by the time we wrote this report, and one subject could not recall or locate information.

Consistent with our previous report,[6] we used an intent-to-treat statistical method to calculate the projected one-year follow-up results for the four subjects in the EI group and the two subjects in the NI group for whom data were missing. The statistical method used was the last-observation-carried-forward (LOCF) approach in which missing values are replaced with the last nonmissing value.[22] There were no statistical differences between patients who completed the one-year follow-up (n = 86) and those who did not (n = 7) with regard to primary demographic variables (three patients were not eligible for the one-year follow-up visit at the time of the analyses).

RESULTS

Demographic characteristics. Table 1 presents the demographic characteristics of patients in the EI and NI groups. We found no significant differences between these groups at baseline with regard to sex, race, marital status, employment status, health insurance status, age, monthly income before taxes, referral type (dental versus nondental provider) and duration of jaw pain.

Copyright ©2007 American Dental Association. All rights reserved.
Downloaded from jada.ada.org on March 3, 2009

Major pain and psychosocial outcomes. Table 2 presents the mean scores and standard deviations for the major outcome measures reported in our earlier study.[6] We should point out that these scores changed somewhat because of the slightly different cohort used in this study. All of the results, however, are consistent with those of the earlier study. As in our earlier study, these results show significant differences between the two groups with regard to self-reported pain (CPI), depression (BDI-2) and problem-focused coping (WOC).

Cost data. In terms of the total amount of health care dollars spent on treatment related to jaw pain, only the EI group exhibited a significant reduction in TMD-related health care expenses from intake to the one-year follow-up visit (Table 3). Because the NI group had lower costs at the intake visit than did the EI group, we applied an analysis of covariance to these data, using the intake amount as the covariate. This analysis confirmed the lower costs at follow-up associated with the EI group for treatment related to jaw pain ($F_{1,93} = 5.64$, $P = .029$). We also should point out that, because these data revealed that the mean costs decreased from intake to the one-year follow-up for both groups, we can view the LOCF method used for missing data as a conservative approach.[22]

Table 4 (page 207) provides a summary of health care visits related to jaw pain, according to various types of providers (for example, general dentists, orthodontists, oral surgeons, chiropractors) outside the study, during the period from onset of pain to intake and during the period from intake to the one-year follow-up visit. As the table shows, patients visited a wide array of health care providers in search of treatment to reduce their jaw pain. We also conducted an analysis to compare the mean proportion of visits in the EI group that were non–TMD-related with that in the NI group. The results showed no significant differences ($t_{94} = 0.91$, $P = .36$). Thus, the type of health care visit (that is, TMD-related versus non–TMD-related) was comparable between the two groups.

Finally, we also addressed the question of whether the reduced health care costs for the EI group could be attributed directly to changes in pain and depression symptomatology. We performed multiple regression analyses for this purpose. For the association between change in costs and change in BDI-2 from intake to the one-year follow-up visit, to control for differences in groups (EI versus NI), we included group as an

TABLE 1

Demographic data.

VARIABLE	EARLY INTERVENTION (n = 57)	NONINTERVENTION (n = 39)
Sex, No. (%) of Subjects		
Male	10 (10.4)	10 (10.4)
Female	47 (49.0)	29 (30.2)
Race, No. (%) of Subjects		
White	40 (41.7)	33 (34.4)
Hispanic	4 (4.2)	3 (3.1)
African-American	6 (6.3)	2 (2.1)
Asian	4 (4.2)	1 (1.0)
Other	3 (3.1)	0 (0)
Marital Status, No. (%) of Subjects		
Single	13 (13.5)	9 (9.4)
Married/living together as married	40 (41.7)	25 (26.0)
Divorced or separated	4 (4.2)	5 (5.2)
Employment Status, No. (%) of Subjects		
Working full-time	31 (32.3)	24 (25.0)
Working part-time	6 (6.3)	2 (2.1)
Not working because of jaw problems	0 (0)	1 (1.0)
Not working because of injury	2 (2.1)	0 (0)
Self-employed	3 (3.1)	3 (3.1)
Non–income-producing activities*	10 (10.4)	4 (4.2)
Not working before jaw pain and still not working	5 (5.2)	5 (5.2)
Referral Type, No. (%) of Subjects		
Nondental provider	26 (27.1)	14 (14.6)
Dental provider	31 (32.3)	25 (26.0)
Mean Education (Years)	15.21	15.79
Mean Age (Years)	36.96	38.39
Mean Monthly Income Before Taxes (Dollars)	6,301	10,514
Mean Duration of Jaw Pain (Days)	98.21	100.21

* Such as retired, keeping house, volunteer activities.

Downloaded from jada.ada.org on March 3, 2009

Copyright ©2007 American Dental Association. All rights reserved.

TABLE 2

Summary scores of various measures at intake and one-year follow-up visit, by group.*†

MEASURE	EARLY INTERVENTION (EI) (n = 57)		NONINTERVENTION (NI) (n = 39)	
	Intake	One Year	Intake	One Year
Characteristic Pain Inventory‡[18] (Pain Measure)	57.14 (11.91)	22.96 (18.21)	56.90 (12.36)	34.36 (23.95)
Beck Depression Inventory-2§[19] (Depression Measure)	9.35 (10.05)	5.33 (7.11)	9.51 (7.49)	8.72 (9.71)
Ways of Coping-Revised (Coping Measure)[20]				
Blamed self¶	17.34 (4.35)	15.73 (4.40)	17.04 (5.38)	16.94 (4.76)
Wishful thinking	19.47 (4.22)	18.61 (4.64)	19.01 (3.92)	18.97 (3.45)
Avoidance	16.57 (2.97)	15.85 (3.06)	15.94 (3.41)	16.49 (3.52)
Problem-focused¶#	23.27 (4.14)	24.98 (3.41)	23.04 (5.07)	23.37 (4.02)
Seeks social support	23.33 (5.02)	24.82 (4.90)	24.98 (5.48)	24.23 (5.81)

* This subsample was taken from a larger, ongoing study.[6] Of the 113 subjects in the larger study considered to be at high risk of developing acute jaw pain, 96 were included in this smaller study, because financial data were available for all of them.
† All data are mean (standard deviation) scores.
‡ Significant difference between EI and NI groups at one-year follow-up visit (t_{94} = - 2.65, P = .01) (no significant difference at intake). This finding was confirmed by a significant analysis of variance interaction effect ($F_{1,94}$ = 6.28, P = .01).
§ Significant difference between EI and NI groups at one-year follow-up visit (t_{94} = - 1.97, P = .05) (no significant difference at intake). This finding was confirmed by a significant difference in change from intake to one-year follow-up visit between the two groups (Mann-Whitney U = 840.00, z = - 2.04, P = .04).
¶ Within the EI group, significant changes were found from intake to one-year follow-up visit on the "blamed self" (t_{56} = 2.39, P = .02) and "problem-focused" (t_{56} = - 2.73, P = .01) subscales.
# Significant difference between EI and NI groups at one-year follow-up visit (t_{94} = 2.11, P = .04).

TABLE 3

Cost data, by group.

DATA COLLECTION POINT	MEAN JAW-RELATED HEALTH CARE COSTS PER SUBJECT (DOLLARS)	
	Early Intervention (n = 57)	Nonintervention (n = 39)
Intake*	768.27	471.35
One-Year Follow-Up Visit†	131.67	433.75

* Time at which data were collected regarding costs incurred for the period between the onset of pain and the intake appointment.
† Time at which data were collected regarding costs incurred for the period between the intake appointment and the one-year follow-up visit.

independent variable in the model. The results indicated that the BDI-2 was not a significant predictor when we controlled for group (t_1 = 0.62, P = .54). Similarly, we found no significant relationship between the CPI and costs (after controlling for the group) (t_1 = 0.16, P = .87).

DISCUSSION

Controversy regarding the treatment of TMD is a long-standing issue among researchers and clinicians.[23,24] Despite this, beginning in the late 1990s, a trend toward more conservative forms of treatment (versus the more invasive treatments of the past) has emerged.[25-28] Stohler and Zarb,[24] in their insightful article about this controversy, make a plea for a "low-tech, high prudence therapeutic approach." Cognitive-behavioral approaches have been identified as conservative interventions that have been helpful to many patients with TMD.[6,7,29-31] However, no studies, to our knowledge, have assessed the cost-benefit ratio of these treatments.

Cognitive-behavioral interventions. The findings of our study suggest that cognitive-behavioral interventions represent not only therapeutically efficacious treatment for TMD, as evidenced by outcomes reported earlier,[6] but also cost-effective treatment, particularly when used in the acute stage of the dysfunction. Our findings demonstrate that subjects who received the six-session, noninvasive early intervention reduced their TMD-related health care costs significantly in the year after the onset of pain.

Of course, this study evaluated early biopsychosocial intervention for HR patients only. We would expect even low-risk patients to benefit; however, future studies will need to investigate this. Moreover, as noted in our earlier study,[6] we did not include an attention-placebo (that is, an ineffectual but harmless treatment) because of ethical issues. Therefore, some may view the NI group as a less-than-conservative contrast (that is, they did not receive a similarly time-demanding intervention).

In addition, this study intentionally excluded

Copyright ©2007 American Dental Association. All rights reserved.
Downloaded from jada.ada.org on March 3, 2009

TABLE 4

Jaw pain–related health care visits before intake and between intake and one-year follow-up visit.

PROVIDER	NO. (%) OF HEALTH CARE VISITS/COSTS PER PROVIDER ($)			
	Early Intervention (n = 57)		Nonintervention (n = 39)	
	Intake* (n = 60 visits)	One year† (n = 14 visits)	Intake*(n = 35 visits)	One year† (n = 18 visits)
Chiropractor	0 (0)/0	0 (0)/0	1 (4.3)/800	0 (0)/0
General Dentist	50 (90.5)/39,568	12 (75.0)/5,627	30 (76.9)/14,137	14 (89.5)/15,146
Massage Therapist	1 (0.3)/150	1 (13.0)/975	1 (2.0)/375	1 (5.3)/900
Physician	6 (7.2)/3,129	0 (0)/0	2 (5.8)/1,070	1 (0.3)/50
Oral Surgeon	1 (1.6)/720	0 (0)/0	1 (10.9)/2,000	0 (0)/0
Physical Therapist	1 (0.3)/150	1 (12.0)/903	0 (0)/0	1 (4.3)/720
Psychologist	0 (0)/0	0 (0)/0	0 (0)/0	1 (0)/100
Ophthalmologist	1 (0.2)/75	0 (0)/0	0 (0)/0	0 (0)/0

* Time at which data were collected for costs incurred for the period between the onset of pain and the intake appointment.
† Time at which data were collected for costs incurred for the period between the intake appointment and the one-year follow-up visit.

patients with fibromyalgia, which may have further contributed to an overly conservative estimate of the ratio between treatment benefits and costs. That said, although health care providers often identify a comorbidity of TMD and fibromyalgia, one study found that, among a group of patients with a primary diagnosis of fibromyalgia, TMD frequently co-occurred (24 percent). In contrast, among a group of patients with a primary diagnosis of chronic TMD, the rate of co-occurrence with fibromyalgia was much lower (9 percent).[32] Therefore, based on these findings of Aaron and colleagues,[32] we can conclude that patients who have TMD as a primary diagnosis may be a "less sick" group than patients with fibromyalgia, who typically have a relatively high co-occurrence of multiple diagnoses, including irritable bowel syndrome and chronic low back pain.

In addition, all studies identified thus far focused exclusively on chronic pain conditions, whereas the intent of our study was to evaluate patients early in the pain process. Therefore, to allow for generalization of results among patients with acute jaw pain, we excluded people with chronic pain symptom patterns.

Study limitations. One potential limitation of our study was the method of collecting cost data, which relied on subjects to provide receipts and insurance EOB statements, as well as on our own review of providers' billing records. Although these billing records are a good source of information, they were not available for all subjects. This leads to the difficulty with the first source of data, which may involve human error in recall and memory (for example, some patients may not have remembered to keep or bring receipts, and patients had to recall dates of service). Indeed, some people had missing data for various reasons. However, we found no differences between those missing one-year data and those who had the one-year data. Still, future studies should focus on more aggressive data collection efforts to strengthen our findings.

In addition, we intend to follow up these patients with acute jaw pain for another year to determine if subjects in the EI group continue to experience reduced health care costs and if subjects in the NI group experience rising or stable costs. Future studies also should seek to include the cost of the intervention itself to provide a more comprehensive evaluation of the cost-effectiveness of early intervention among patients with jaw pain.

CONCLUSION

The reduced jaw-related health care expenditures for patients in the EI group compared with those for patients in the NI group at one year suggest that an early biopsychosocial intervention is a cost-effective method of treating TMD-related pain that often involves unnecessarily high costs.

Copyright ©2007 American Dental Association. All rights reserved.
Downloaded from jada.ada.org on March 3, 2009

Clinicians need to consider such an approach when developing treatment plans for these difficult-to-treat patients. ■

This study was supported, in part, by National Institutes of Health grants 2 R01 DE10713, 3 R01 MH 46452 and 1 K05 MH 071892.

This article is dedicated to the memory of Lynn Wildenstein.

1. Greco CM, Rudy TE, Harlich A. Temporomandibular disorders. In: Manu P, ed. Functional somatic syndromes: Etiology, diagnosis, and treatment. Cambridge, England: Cambridge University Press; 1998:127-58.
2. Gelb H. Preface. In: Gelb H, ed. New concepts in craniomandibular and chronic pain management. Philadelphia: Mosby-Wolfe; 1994:i-iii.
3. Dworkin SF, Huggins KH, LeResche L, et al. Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls. JADA 1990;120(3):273-81.
4. Okeson JP. Etiology of functional disturbances in the masticatory system. In: Okeson JP, ed. Management of temporomandibular disorders and occlusion. 3rd ed. Philadelphia: Mosby; 1993:149-77.
5. Sharav Y. Orofacial pain. In: Wall PD, ed. Textbook of pain. 3rd ed. New York City: Churchill Livingstone; 1994:563-82.
6. Gatchel RJ, Stowell AW, Wildenstein L, Riggs R, Ellis E 3rd. Efficacy of an early intervention for patients with acute temporomandibular disorder-related pain: a one-year outcome study. JADA 2006;137(3):339-47.
7. National Institutes of Health. Technology assessment conference statement: National Institutes of Health Technology Assessment Conference on Management of Temporomandibular Disorders. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997;83:177-83.
8. Von Korff M. Health services research and temporomandibular pain. In: Sessle BJ, Bryant PS, Dionne RA, eds. Temporomandibular disorders and related pain conditions. Seattle: IASP Press; 1995:227-36.
9. Von Korff M, Ormel J, Keefe FJ, Dworkin SF. Grading the severity of chronic pain. Pain 1992;50(2):133-49.
10. Garro LC, Stephenson KA, Good BJ. Chronic illness of the temporomandibular joints as experienced by support-group members. J Gen Intern Med 1994;9(7):372-8.
11. Brotman SG. Managed health care and orofacial pain. Dent Clin North Am 1997;41(2):297-307.
12. White BA, Williams LA, Leben JR. Health care utilization and cost among health maintenance organization members with temporomandibular disorders. J Orofac Pain 2001;15(2):158-69.
13. Shimshak DG, DeFuria MC. Health care utilization by patients with temporomandibular joint disorders. Cranio 1998;16(3):185-93.
14. Shimshak DG, Kent RL, DeFuria M. Medical claims profiles of subjects with temporomandibular joint disorders. Cranio 1997;15(2):150-8.
15. Kuttila M, Kuttila S, Le Bell Y, Alanen P. Association between TMD treatment need, sick leaves, and use of health care service for adults. J Orofac Pain 1997;11(3):242-8.
16. The TMJ Association Ltd. TMJ diseases & disorders-insurance. Available at: "www.tmj.org/insurance3.asp". Accessed Dec. 27, 2006.
17. Wright AR, Gatchel RJ, Wildenstein L, Riggs R, Buschang P, Ellis E 3rd. Biopsychosocial differences between high-risk and low-risk patients with acute TMD-related pain. JADA 2004;135(4):474-83.
18. Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. J Craniomandib Disord 1992;6(4):301-55.
19. Beck AT, Steer RA, Brown GK. Beck Depression Inventory manual. 2nd ed. San Antonio: Psychological Corp.; 1996.
20. Folkman S, Lazarus RS. Manual for the Ways of Coping Questionnaire: Research edition. Palo Alto, Calif: Consulting Psychologists Press; 1988.
21. Epker J, Gatchel RJ, Ellis E 3rd. A model for predicting chronic TMD: practical applications in clinical settings. JADA 1999;130(10):1470-5.
22. Shao J, Zhong B. Last observation carry-forward and last observation analysis. Stat Med 2003;22(15):2429-41.
23. Greene CS. The etiology of temporomandibular disorders: implications for treatment. J Orofac Pain 2001;15(2):90-105.
24. Stohler CS, Zarb GA. On the management of temporomandibular disorders: a plea for a low-tech, high-prudence therapeutic approach. J Orofac Pain 1999;13(4):255-61.
25. Marbach JJ. Temporomandibular pain and dysfunction syndrome: history, physical examination, and treatment. Rheum Dis Clin North Am 1996;22(3):477-98.
26. Turk DC, Rudy TE, Kubinski JA, Zaki HS, Greco CM. Dysfunctional patients with temporomandibular disorders: evaluating the efficacy of a tailored treatment protocol. J Consult Clin Psychol 1996;64(1):139-46.
27. Dworkin SF. Behavioral and educational modalities. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997;83(1):128-33.
28. Dworkin SF, Turner JA, Wilson L, et al. Brief group cognitive-behavioral intervention for temporomandibular disorders. Pain 1994;59(2):175-87.
29. Mishra KD, Gatchel RJ, Gardea MA. The relative efficacy of three cognitive-behavioral treatment approaches to temporomandibular disorders. J Behav Med 2000;23(3):293-309.
30. Gardea MA, Gatchel RJ, Mishra KD. Long-term efficacy of biobehavioral treatment of temporomandibular disorders. J Behav Med 2001;24(4):341-59.
31. Sherman JJ, Turk DC. Nonpharmacologic approaches to the management of myofascial temporomandibular disorders. Curr Pain Headache Rep 2001;5(5):421-31.
32. Aaron LA, Burke MM, Buchwald D. Overlapping conditions among patients with chronic fatigue syndrome, fibromyalgia, and temporomandibular disorder. Arch Intern Med 2000;160(2):221-7.

Downloaded from jada.ada.org on March 3, 2009

Copyright ©2007 American Dental Association. All rights reserved.