Effectiveness of Conservative Treatment for Craniomandibular Disorders: A 2-Year Longitudinal Study

Pavlos Garefis, DDS, PhD
Professor and Chairman

Elizabeth Grigoriadou, DDS,
Research Fellow

Alexandra Zarifi, DDS
Research Fellow

Petros T. Koidis, DDS, MS, PhDc
Assistant Professor

Department of Fixed Prosthodontics
Aristotle University of Thessaloniki
School of Dentistry
Thessaloniki, Greece

Correspondence to:
Dr Pavlos Garefis
18 Agias Sofias Street
54622 Thessaloniki
Greece

The severity of symptoms of craniomandibular disorders was studied during a 2-year period in 195 patients treated with conservative therapeutic schemes. Results revealed a continuing improvement and a statistically significant tendency for the great majority of patients to become asymptomatic or show a decrease in the severity of symptoms. By the end of the 2 years, 66.7% of the patients were symptom free, 25.6% presented with slight symptomatology, and 3.1% were recorded with a fluctuating recurrence of symptoms. This investigation provided the data to develop an exponential model for the hypothesis that stabilization of effectiveness of conservative treatment is achieved between 6 months and 1 year after the initiation of treatment.
J OROFACIAL PAIN 1994;8:309–314.

Dysfunction of the stomatognathic system (SGS) or craniomandibular disorders (CMD) are the most common terms today for describing the wide range of pathologic entities that affect the SGS. Over the years, several controversial theories have been proposed to explain the onset of these disorders, but the most acceptable theory is that of the multifactorial etiology.[1-5] In addition, a great number of epidemiologic studies provided valuable information regarding the determination of criteria for differential diagnosis as well as evaluation of severity for the different forms of CMD.[6-15]

Several investigators and clinicians have proposed a variety of therapeutic modalities for the treatment of CMD, with the spectrum varying from the most aggressive to the most conservative.[16-22] However, although the information has been very descriptive in terms of techniques, the presentation of documented longitudinal results of treatment has been somewhat limited.[23-28]

The aims of this investigation were: *(a)* to evaluate the effectiveness of conservative therapeutic schemes in a large sample of patients with CMD over a prolonged period of time; and *(b)* to determine the variability of intensity of symptoms of CMD during a prolonged period of time.

Materials and Methods

The study consisted of 195 patients (47 men and 148 women; age range 16 to 70 years; Table 1) referred to the Clinic of Physiology or the Stomatognathic System of the Laboratory of Fixed Prosthodontics of the Aristotle University of Thessaloniki, Greece. The basic

criteria for the patients' selection and participation in the study were the documented presence of signs and symptoms of CMD, such as limited range or disturbed mandibular movement; masticatory muscle or temporomandibular joint (TMJ) pain; TMJ sounds; pain on jaw movement; and the willingness to undergo a proposed treatment and recall evaluation. Patients with both clinical and radiographic documentation of organic changes within the TMJ were excluded from the sample.

For each patient, a standardized protocol was followed that contained:

A. Collection of personal and demographic data.
B. General examination through medical and dental history.
C. A two-part examination for signs and symptoms of CMD. In the first part, a questionnaire was used to reveal information regarding subjective signs and symptoms and determine the Anamnestic Dysfunction Index (Ai).[29] Questions were introduced by an experienced examiner and all patients responded either yes or no. In the second part, a clinical examination for signs and symptoms of CMD was performed by a team of examiners and part of the recorded data was used to determine a Clinical Dysfunction Index (Di).[29]
D. When data recording for each patient had been completed, classification of symptoms was performed and symptom severity was estimated according to the relative Helkimo's Scale (Table 2).[29]
E. Upon completion of the evaluation and classification of each patient, a conservative therapeutic scheme was initiated that included one or more of the following: explanatory interview; exercises of the mandible with or without active resistance; occlusal splints; and occlusal equilibration with selective adjustment of teeth.
F. Effectiveness of treatment was evaluated 2 weeks, 2 months, 6 months, 1 year, and 2 years after the initial application of treatment. The severity of symptoms was registered according to the initially used Helkimo's Scale in every follow-up session.

When the entire data had been collected and manipulated, statistical analysis was performed. The SPSS software (Statistical Package for Social Sciences, version 3.1, SPSS, Chicago, IL) was used, with the contingency tables and the chi-square test as the main method to test the statistical significance or correlations between variables and differences between groups. The following levels of significance were used: NS (not significant); $P \geq .05$; $P < .05$; $P < .01$; and $P < .001$.

Results

At the pretreatment examination, 42.3% of the patients presented with Class 2 severity of symptoms, while 23.7% presented with Class 1, 22.2% with Class 3, 10.3% with Class 4, and 1.5% with Class 5 (Fig 1, a).

Two weeks after the start of the treatment, 14.9% of the patients became asymptomatic

Table 1 Age and Sex Distribution of Patients

Age (y)	Women (n)	Men (n)	Total
16–29	78	22	100
30–49	27	15	42
50–70	43	10	53
Total	148	47	195

Table 2 Scale of Severity of Symptoms

Class	Points	Presence of clinical symptoms	Dysfunction Group	Di
0	0	No clinical symptoms	0	Di0
1	1–4	Only mild symptoms	1	DiI
2	5–9	One severe symptom combined with none to four mild symptoms (or five mild symptoms)	2	DiII
3	10–13	Two severe symptoms combined with none to three mild symptoms	3	DiIII
4	15–17	Three severe symptoms combined with none to two mild symptoms	4	DiIIII
5	20–25	Four severe symptoms and possibly one mild symptom or five severe symptoms	5	DiIIIII
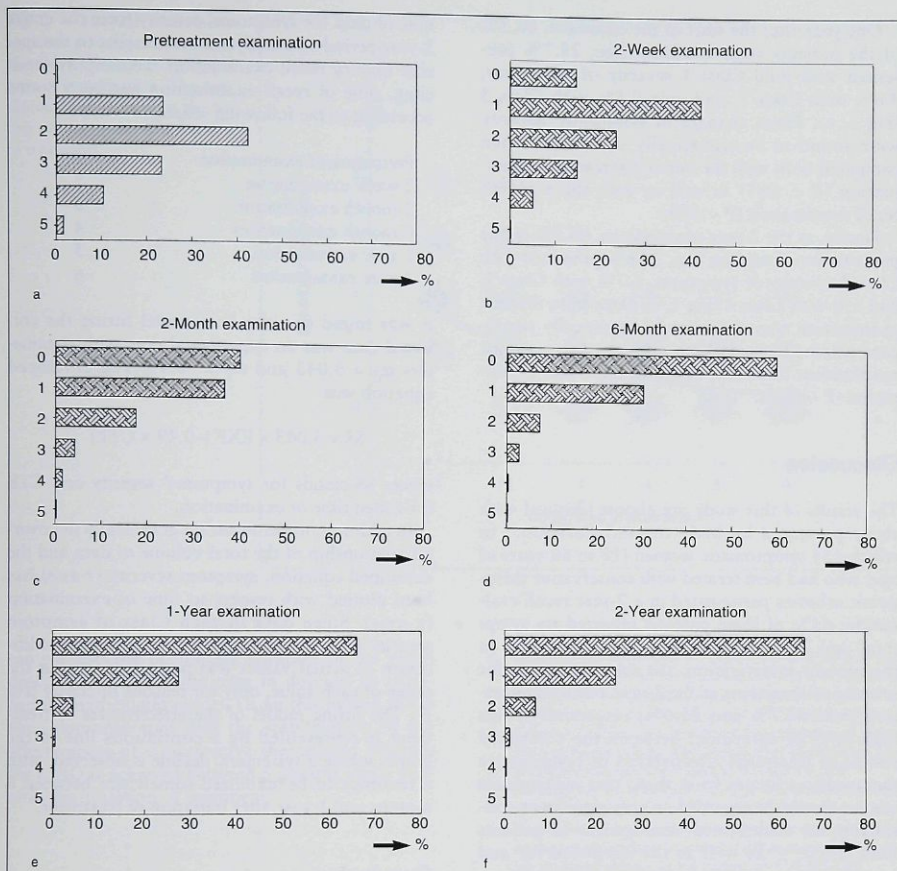
Figs 1a to 1f Comparison of severity of symptoms at the pretreatment examination, and at 2 weeks, 2 months, 6 months, 1 year, and 2 years after initiation of treatment (left axis of each graph = scale).

(Class 0), 42.1% presented with Class 1 severity of symptoms, 23.1% with Class 2, 14.9% with Class 3, and 5.1% with Class 4 (Fig 1, b). No patients with Class 5 severity of symptoms presented after the 2-week examination. This tendency of patients to move into classes of decreased severity of symptoms was statistically significant (P < .001).

At the 2-month examination, 40% of the patients were asymptomatic (Class 0), 36.9% presented with Class 1 severity of symptoms, 17.4% with Class 2, 4.1% with Class 3, and only 1.5% with Class 4 (Fig 1, c). These changes were statisti-

cally significant when compared both with the initial pretreatment examination (P < .001) and the 2-week examination (P < .001).

Six months after the start of the treatment, 60% of the patients were asymptomatic, 30.3% presented with Class 1 severity of symptoms, 7.2% with Class 2, and only 2.6% with Class 3 (Fig 1, d). There were no patients with either Class 4 or 5 severity of symptoms. This improvement was also statistically significant when compared both with the pretreatment examination (P < .001) and with data from the 2-month examination (P < .001).

One year after the start of the treatment, 66.2% of the patients were symptom free, 28.7% presented with mild Class 1 severity of symptoms, 4.6% with Class 2, and only 0.5% with Class 3 (Fig 1, e). These changes of symptoms' severity were found to be statistically significant when compared both with the initial pretreatment examination ($P < .001$) as well as with the 6-month recall examination ($P < .001$).

Finally, at the 2-year examination, 66.7% of the patients were symptom free, 25.6% presented with Class 1 severity of symptoms, 6.7% with Class 2, and 1% with Class 3 (Fig 1, f). Data from this last examination were found to be statistically significant when compared both with the pretreatment examination ($P < .001$) and with the 1-year examination ($P < .001$).

Discussion

The results of this study are almost identical with those presented by Mejersjo and Carlsson,[30] in which 154 symptomatic women (18 to 60 years of age) who had been treated with conservative therapeutic schemes participated in a 7-year recall evaluation; 65% of these patients reported no symptoms and 22% reported only slight symptoms. In the present investigation, the relative classes for severity of symptoms at the 2-year recall examination were 66.7% and 25.6%, respectively. This high level of agreement between the compared results of treatment effectiveness of conservative therapeutic schemes from these two independent studies should be regarded as very significant considering the documented heterogeneity of patients with CMD,[31,32] as well as the intraobserver and interobserver variability in the functional examination of SGS.[33]

The major improvement in the severity of symptoms was observed at the 6-month examination, during which 60% of the patients were symptom free, and 30.3% presented with Class 1 severity of symptoms. During the time between the 1-year and 2-year examinations, a low rate of recurrence of symptoms was monitored (approximately 3.1%), which agrees with the rate reported by Mejersjo and Carlsson[30] but is very minimal compared to reports from other studies (25% to 40%).[25,34,35] This difference may be due to the exclusive use of clinical examination for the determination of severity of symptoms in the present study.

For statistical documentation of the effectiveness of conservative therapeutic schemes, the total vol- ume of data for symptoms' severity from the entire 2-year period was analyzed with respect to the specific time of recall examination. To simplify modeling, time of recall examination has been coded according to the following scheme:

Pretreatment examination	:	1
2-week examination	:	2
2-month examination	:	3
6-month examination	:	4
1-year examination	:	5
2-year examination	:	6

It was found that the best model fitting the collected data was an exponential one, with parameters $\alpha_0 = 3.043$ and $\alpha_1 = -0.49$. The developed equation was

$$SS = 3.043 \times EXP\ (-0.49 \times CTE)$$

where SS stands for symptoms' severity and CTE for coded time of examination.

In addition, to demonstrate graphically the overall relationship of the total volume of data and the developed equation, symptom severity (y-axis) has been plotted with respect to time of examination (x-axis). Since data in each Class of symptom severity were discrete (eg, 0, 1, 2...), small modification of actual values was performed, within the range of each value, only for reasons of clarity (Fig 2). The fitting model of the effectiveness of treatment is represented by a continuous line in the graph, where a systematic decline is observed, with a tendency to be stabilized somewhere between 6 months and 1 year after initiation of treatment.

Conclusion

The severity of symptoms of CMD was studied during a 2-year period in 195 patients treated with conservative therapeutic schemes. The results of this investigation revealed both a continuing improvement and a statistically significant tendency for the great majority of patients to become asymptomatic. Thus, by the end of the 2-year period, 66.7% of the patients were symptom free, and 25.6% presented with minimal Class 1 severity of symptoms (considered as subclinical symptomatology), and only 6.7% and 1% presented with Class 2 and Class 3 severity of symptoms, respectively. In addition, only a minimal 3.1% fluctuating recurrence of severity of symptoms was observed, mainly between the first and second year of the posttreatment evaluation period. The size of the

Fig 2 Overall treatment response severity of symptoms plotted with respect to coded time of examination. The continuous line represents the fitting model of the effectiveness of treatment.
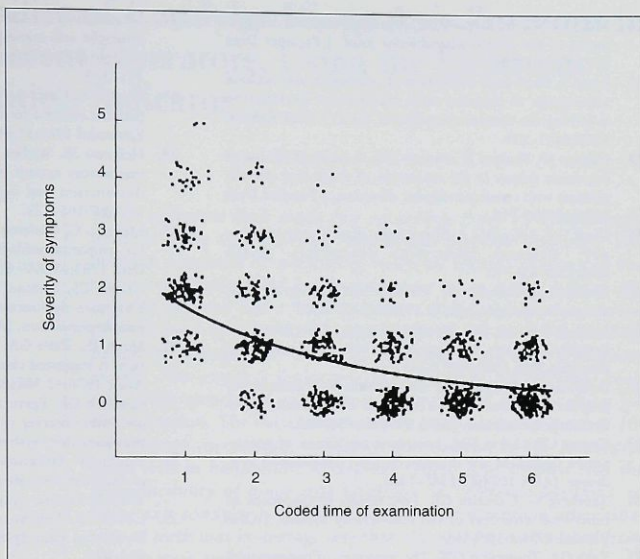
sample and the prolonged duration of the recall procedure provided the data to develop an exponential mathematic model. Using this model, it has been demonstrated that the stabilization of the effectiveness of conservative therapeutic schemes for CMD is achieved between 6 months and 1 year after the initiation of treatment.

References

1. De Boever JA. Functional disturbances of the temporomandibular joint. In: Zarb GA, Carlsson GE (eds). Temporomandibular Joint Function and Dysfunction. Copenhagen: Munksgaard, 1979:193–214.
2. Rugh JD, Solberg WK. Psychological implications in temporomandibular pain and dysfunction. In: Zarb GA, Carlsson GE (eds). Temporomandibular Joint Function and Dysfunction. Copenhagen: Munksgaard, 1979: 239–268.
3. Zarb GA, Speck JE. The treatment of mandibular dysfunction. In: Zarb GA, Carlsson GE (eds). Temporomandibular Joint Function and Dysfunction. Copenhagen: Munksgaard, 1979:373–396.
4. Weinberg LA, Lager LA. Clinical report on the etiology and diagnosis of TMJ dysfunction-pain syndrome. J Prosthet Dent 1980;44:642–653.
5. Farrar WB. Craniomandibular practice: The state of the art; definition and diagnosis. J Craniomand Pract 1982;1:5–12.
6. Agerberg G, Carlsson GE. Functional disorders of the masticatory system. Symptoms in relation to impaired mobility of the mandible as judged from investigation by questionnaire. Acta Odontol Scand 1973;31:335–347.
7. Liansson T, Nilner M. A study of the occurrence of symptoms of diseases of the TMJ, masticatory musculature and related structures. J Oral Rehabil 1975;2:313–324.
8. Helkimo M. Epidemiologic surveys of dysfunction of the masticatory system. Oral Sci Rev 1976;7:54–69.
9. Grosfeld O, Czarnecka B. Musculoarticular disorders of the stomatognathic system in school children examined according to clinical criteria. J Oral Rehabil 1977;4:193–200.
10. Norheim PW, Dahl BL. Some self-reported symptoms of temporomandibular joint dysfunction in a population in Northern Norway. J Oral Rehabil 1978;5:63–68.
11. Solberg WK, Woo MW, Houston JB. Prevalence of mandibular dysfunction in young adults. JADA 1979;98:25–55.
12. Wigdorowicz-Makowerowa N, Grodki C, Panek H, Maslanka T, Plonka K, Palacha A. Epidemiological studies on prevalence and etiology of functional disturbances of the masticatory system. J Prosthet Dent 1979;41:76–82.
13. Greene CS, Marbach JJ. Epidemiological studies of mandibular dysfunction: A critical review. J Prosthet Dent 1982;48:184–190.
14. Clark GT, Seligman DA, Solberg WK, Pullinger AG. Guidelines for the examination and diagnosis of temporomandibular disorders. J Craniomandib Disord Facial Oral Pain 1989;3:7–14.
15. Burch JG. History and clinical examination. In: Laskin D, Greenfield W, Gale E, Rugh J (eds): The President's Conference on the Examination, Diagnosis and Management of Temporomandibular Disorders. Chicago: American Dental Association, 1983:51–56.

16. McCarty WL Jr, Farrar WB. Surgery for internal derangements of the temporomandibular joint. J Prosthet Dent 1979;42:191–196.

17. Kopp S. Short term evaluation of counseling and occlusal adjustment in patients with mandibular dysfunction involving the temporomandibular joint. J Oral Rehabil 1979;6:l01–109.

18. Okeson JP, Kemper JT, Moody PM. A study of the use of occlusion splints in the treatment of acute and chronic patients with craniomandibular disorders. J Prosthet Dent 1982;48:708–712.

19. Clark GT, Adler RC. A critical evaluation of occlusal therapy: Occlusal adjustment procedures. JADA 1985;110:743–750.

20. Marbach JJ, Dworkin SF. Chronic MPD, group therapy, and psychodynamics. JADA 1975;9O:327–333.

21. Scott DS, Gregg JM. Myofascial pain of the temporomandibular joint: A review of the behavioral-relaxation therapies. Pain 1980;9:231–241.

22. Dohrmann RJ, Laskin D. An evaluation of electromyographic biofeedback in the treatment of myofascial pain-dysfunction syndrome. JADA 1978;96:656–662.

23. Greene CS, Laskin DM. Long-term evaluation of conservative treatment for myofascial pain dysfunction syndrome. JADA 1974;89:1365–1368.

24. Agerberg G, Carlsson GE. Late results of treatment of functional disorders of the masticatory system. J Oral Rehabil 1974;1:309–316.

25. Zarb GA, Thompson GW. The treatment of patients with temporomandibular joint pain dysfunction syndrome. J Can Dent Assoc 1975;41:410–417.

26. Heloe B, Heiberg AN. A follow-up study of a group of female patients with myofascial pain-dysfunction syndrome. Acta Odontol Scand 1980;38:129-134.

27. Magnusson T, Carlsson GE. Changes in recurrent headache and mandibular dysfunction after various types of dental treatment Acta Odontol Scand 1980;38: 311–320.

28. Wedel A, Carlsson GE. Retrospective review of 350 patients referred to a TMJ clinic. Community Dent Oral Epidemiol 1983;11:69–73.

29. Helkimo M. Studies on function and dysfunction of the masticatory system. II. Index for anamnestic and clinical dysfunction and occlusal state. Sven Tandlak Tidskr 1974;67:101–121.

30. Mejersjo C, Carlsson GE. Long term results of treatment for temporomandibular joint pain dysfunction. J Prosthet Dent 1983;49:809–815.

31. Greene CS, Lerman MD, Sutcher HD, Laskin DM. The TMJ pain-dysfunction syndrome. Heterogeneity of the patient population. JADA 1969;79:1168–1172.

32. Speck JE, Zarb GA. Temporomandibular pain-dysfunction: A suggested classification and treatment. J Can Dent Assoc 1976;42:305–310.

33. Carlsson GE, Egermark-Eriksson I, Magnusson T. Intra- and inter-observer variation in functional examination of the masticatory system. Swed Dent J 1980;4:187–194.

34. Dachi SF. Diagnosis and management of temporomandibular joint dysfunction syndrome. J Prosthet Dent 1968;20:53–61.

35. Cohen SR. Follow-up evaluation of 105 patients with myofascial pain-dysfunction syndrome. JADA 1978;97: 825–828.

Resumen

La efectividad del tratamiento conservativo de los desórdenes craneomandibulares: Estudio longitudinal de dos años

Se estudió la severidad de los síntomas de los desórdenes craneomandibulares durante un periodo de 2 años en 195 pacientes tratados con esquemas terapéuticos conservadores. Los resultados indican un mejoría continua y una tendencia estadísticamente significativa hacia la desaparición de los síntomas o a la disminución de la severidad de los mismos en la gran mayoría de los pacientes. Al final del segundo año, el 66.7% de los pacientes no presentaban síntomas, el 25.6% presentaban sintomatología leve, y sólo en el 3.1% se presentó una recurrencia fluctuante de los síntomas. Esta investigación suministró la información para desarrollar un modelo exponencial en relación a la hipótesis de la efectividad del tratamiento conservador es alcanzadfa entre los 6 mesas y el año luego de la iniciación del tratamiento.

Zusammenfassung

Die Wirksamkeit konservativer Behandlung von Myoarthropathien des Kausystems: eine 2-Jahres Longitudinalstudie

In einer 2-Jahres Periode wurden die Myoarthropathiesymptome von 195 Patienten beobachtet, die nur konservative Therapie erhielten. Die Resultate zeigten eine kontinuierliche Verbesserung und eine statistisch signifikante Tendenz der grossen Mehrheit der Patienten dazu, asymptomatisch zu werden oder zu einer Abnahme der Schwere der Symptome zu gelangen. Am Ende der 2-Jahres Periode waren 66.7% der Patienten symptomlos, 25.6% zeigten eine leichte Symptomatik und nur 3.1% litten unter immer wiederkehrenden Symptomen. Diese Untersuchung lieferte die Daten zur Entwicklung eines exponentiellen Modelles zur Hypothese, dass sich die Wirksamkeit von konservativer Therapie zwischen 6 Monaten und einem Jahr nach Therapiebeginn stabilisiert.