Short-term effect of occlusal adjustment on craniomandibular disorders including headaches

Danila Vallon, Ewa Carin Ekberg, Maria Nilner and Sigvard Kopp
Department of Stomatognathic Physiology, School of Dentistry, University of Lund, Malmö, and Department of Clinical Oral Physiology, Karolinska Institutet, Huddinge, Sweden

Vallon D, Ekberg EC, Nilner M, Kopp S. Short-term effect of occlusal adjustment on craniomandibular disorders including headaches. Acta Odontol Scand 1991;49:89–96. Oslo. ISSN 0001–6357.

The aim of this study was to assess the short-term effect of occlusal adjustment on craniomandibular disorders. Fifty patients were randomly selected and divided into a treatment (T) and a control (C) group. The initial clinical examination and the follow-up were made by one observer and the occlusal adjustment by another. There were no significant differences between groups with regard to frequency of headaches, facial pain, pain on mandibular function, or duration of headaches and facial pain. Fifty-two percent of the patients in the treatment group and 20% of the patients in the control group reported reduced subjective symptoms overall at follow-up examination. The improvement was statistically significant within the T group and significantly greater than in the C group. There was no significant change within or between groups with regard to frequency of headaches, facial pain, or pain on mandibular movements. There was an almost significant difference between groups after treatment with regard to changes in the number of tender muscles. The results of this study indicate that occlusal adjustment provides a general subjective improvement of craniomandibular disorders. □ *Clinical trial; facial pain; masticatory muscles; temporomandibular joint*

Danila Vallon, Department of Stomatognathic Physiology, School of Dentistry, Carl Gustavs v 34, S-214 21 Malmö, Sweden

Mandibular dysfunction, temporomandibular joint (TMJ) pain dysfunction syndrome, myofascial pain dysfunction syndrome (MPD), and craniomandibular disorders (CMD) are terms used synonymously to describe a heterogeneous group of patients with similar symptoms of multifactorial etiology (1–3). The role of occlusal disturbances in the etiology of craniomandibular disorders is still disputed (4). Favorable subjective effects of treatment modalities like occlusal adjustment and occlusal splints have often been taken as evidence of a significant role of the occlusal factor in the etiology of these disorders (5–8). However, the nature of the treatment effects can be questioned, since mock-occlusal adjustment and placebo splint treatment have been found to have a similar effect on subjective symptoms (9, 10).

The aim of this study was to evaluate the short-term effect of occlusal adjustment on craniomandibular disorders of both muscular and non-muscular origin in patients with occlusal interferences.

Patients and methods

Patients

All 1980 patients referred to the Department of Stomatognathic Physiology at the School of Dentistry in Malmö from August 1985 to October 1988 provided the basis for selection.

Patient selection

The patients had to fulfill the following criteria for inclusion: 1) no clinical evidence of systemic joint or muscular disorder; 2) no clinical evidence of organic lesion of the TMJ—that is, no pain, tenderness, or crepitation of the TMJ; 3) own dentition or fixed prosthodontics with at least premolar support; and 4) occlusal interferences (see clinical examination).

Eight hundred and thirty patients (41.9%) were excluded on the basis of the information obtained in the referral. The other 1150 patients were called for a selective examination; of these, 1086 (44.9%) patients did not fulfill the inclusion criteria and were excluded. Sixty-four patients (3.2%) with craniomandibular disorders and a history of headaches were selected for the study.

All patients were informed verbally and in writing about the aims and the design of the project and were free to reject participation in the study in accordance with the principles of the Ethical Committee at the University of Lund.

The information provided included the fact that occlusal adjustment and reassurance are two different therapeutic approaches to treatment of patients with craniomandibular disorders. Fourteen of the 64 patients preferred not to participate; their main reason was the possibility of being assigned to the control group. The study therefore comprised 50 patients.

The patients were randomly assigned to a treatment (T) and a control (C) group. Twenty-five patients, 4 men and 21 women, were assigned to the treatment group, and 25 patients, 2 men and 23 women, to the control group (Table 1).

Methods

The study comprised three visits. The first visit (I) included an interview and a clinical examination made by investigator A. At the second visit (II), 2 weeks later, the patients were randomly assigned to a treatment group (T) or a control group (C), and the interview and clinical examination was repeated. At this visit the T group also received occlusal adjustment by investigator B. The treatment outcome was evaluated 1 month later (visit III) by investigator A, with an interview and clinical examination.

Subjective symptoms

Visit I comprised a standardized interview concerning frequency and duration of headaches and facial pain and complaints about pain during normal jaw function and during extreme mandibular movements. The patients assessed the severity of their subjective symptoms at each visit by means of a visual analogue scale of 100 mm (VAS), on which the end-points were marked 'negligible' and 'unendurable', respectively (11). At visit III the patients were asked about the overall changes in severity of their subjective symptoms by means of a six-grade scale: symptom-free (0), much better (1), slightly better (2), unchanged (3), slightly worse (4), and much worse (5).

Clinical signs

All clinical examinations were performed by investigator A, who was not involved in the occlusal adjustment and had no knowledge about to which group the patients belonged. The clinical examination was identical at the pre- and post-treatment visits. The range of mandibular mobility was measured in the vertical and horizontal

Table 1. Sex and age distribution of treatment (T) and control (C) groups

	T group			C group		
		Age, years			Age, years	
	n	Median	Range	*n*	Median	Range
Male	4	30	19–46	2	36.5	27–46
Female	21	24	15–55	23	29	17–55
Total	25	28	15–55	25	29	17–55

Table 2. Subjective symptoms and clinical findings before treatment for the treatment (T) and the control group (C)

	T, $n = 25$	C, $n = 25$
Subjective symptoms		
Recurrent headaches	100%	100%
Facial pain	64%	48%
Duration of headaches and/or facial pain ≤6 months	4%	12%
Duration of headaches and/or facial pain >6 months	96%	88%
Pain on mandibular function	24%	42%
Tiredness or stiffness of the jaw	52%	72%
Clicking	44%	44%
Assessment of subj. symptoms (VAS), median (range)	64 (0–100)	59 (0–100)
Clinical signs		
Pain on mandibular movements	44%	32%
Clicking and/or deviation of the midline on opening >2mm	44%	72%
Muscle tenderness on palpation	60%	88%
No. of tender muscle regions among patients with palp. findings, median (range)	5 (2–9)	4 (1–13)
Maximal mouth opening capacity, median (range)	51 (38–66)	50 (37–63)
Dysfunction score, median (range)	2 (0–12)	6 (0–12)

planes. Deviations from the midline of more than 2 mm on mouth opening, joint sounds and pain during mandibular movements, and tenderness to palpation of the masticatory muscles were recorded. The following pairs of muscles were palpated: the anterior and posterior temporal muscle, the attachment of the temporal muscle to the coronoid process, the deep and superficial portion of the masseter muscle, the medial and lateral pterygoid muscle, and the posterior belly of the digastric muscle. The number of tender muscles was counted. The degree of disorder was estimated by the clinical dysfunction score in accordance with Helkimo (12). The occlusion was examined by methods previously described and investigated for observer error (13). The slide between the retruded contact position (RCP) and the intercuspal position (IP) was measured in the vertical, horizontal, and frontal planes with a caliper (13). Balancing-side interferences preventing contacts on the working side during lateral movements, sole posterior contacts on the working side, and posterior contacts preventing frontal contacts or causing a deviation of the mandible on protrusive movements were recorded.

Criteria for occlusal adjustment

The following criteria were to be fulfilled by the occlusal adjustment: 1) simultaneous bilateral contacts on guided hinge closure into RCP; 2) removal of lateral slide between the RCP and IP; 3) no balancing-side interferences within lateral movements ≤ 3 mm; 4) canine guidance alone or in group function with premolars and molars on the working side during lateral movements; and 5) no predominant posterior contacts during protrusive movements.

Statistics

Changes in signs and symptoms within and between groups were tested for statistical significance by means of the Wilcoxon matched-pairs signed-ranks test and the Mann–Whitney U-test, respectively. *P* values are given when statistical significance reached a level of $p < 0.05$. Correlations were tested by Spearman's rank correlation coefficient.

Results

The subjective and clinical picture before treatment is presented in Table 2. Headaches and facial pain for 1 to 5 years was reported by 48% of the patients in the T group and by 40% of the patients in the C group. Duration for more than 5 years was reported by 32% and 40% in the two groups, respectively. There were no significant differences in headaches and facial pain between the groups.

The number of tender muscles and frequency of headaches at the initial visit were positively correlated ($r_s = 0.32$, $p = 0.023$) (Fig. 1). This correlation thereby explained about 10% of the variation in headaches.

The initial median values for the maximal opening capacity and the clinical dysfunction score are shown in Table 2. The median value for the number of occluding pairs of teeth in IP before treatment was 13, with a range between 6 and 16 for both groups. The distribution of the occlusal variables in-

Table 3. Frequency distribution (%) for some occlusal variables in the treatment (T) and control group (C) before (I) and 1 month after treatment (III)

	T, n = 25		C, n = 25	
	I	III	I	III
Sagittal distance RCP–IP				
$0 \leq x \leq 0.5$	40	96	20	48
$x > 0.5$	60	4	80	52
Vertical distance RCP–IP				
$0 \leq x \leq 0.5$	32	92	24	28
$x > 0.5$	68	8	76	72
Lateral slide RCP–IP				
$0 \leq x < 0.5$	36	92	16	24
$0.5 \leq x \leq 1$	64	8	84	76
Mediotrusion interferences	60	28	72	84
Laterotrusion interferences	24	4	16	16
Protrusion interferences	8	4	12	8

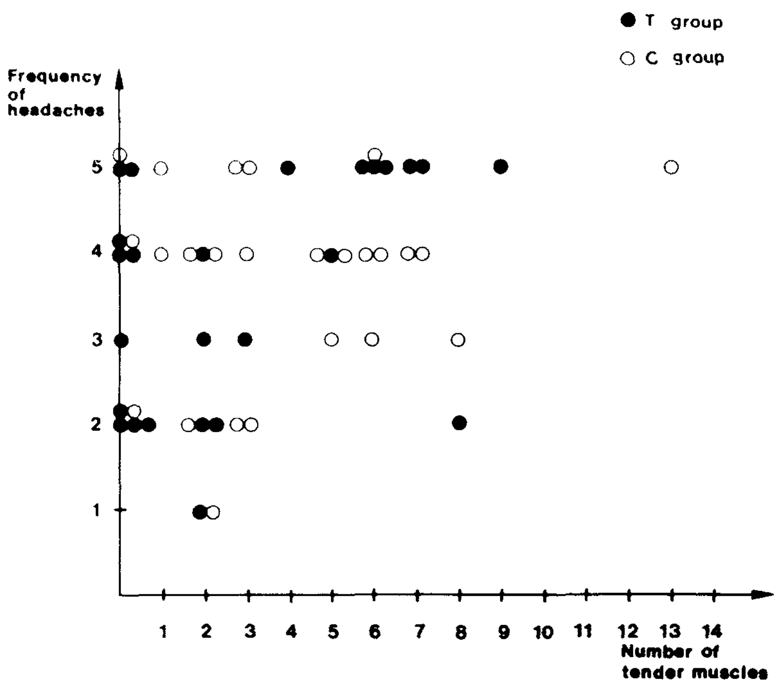

Fig. 1. Relationship between number of tender muscles and frequency of headaches (0 = never, 1 = hardly ever, 2 = once or twice a month, 3 = once a week, 4 = several times a week, 5 = daily) at the initial visit (I) ($r = 0.32$, $p = 0.023$).

Table 4. Changes in overall subjective symptoms between visits I and III in the treatment group (T) and control group (C)

Changes in subjective symptoms	T group, n = 25	C group, n = 25	Diff. T–C
Free from symptoms	1	—	
Much better	5	1	
Slightly better	7	4	
Unchanged	9	10	
Slightly worse	2	4	
Much worse	1	5	
Does not know	—	1	
Diff. I–III	$p = 0.021$	NS	$p = 0.009$

vestigated is presented in Table 3. Most of the patients showed unilateral contacts on guided hinge closure with a sagittal vertical and lateral distance between the RCP and the IP. The T group showed a marked decrease of occlusal interferences 1 month after occlusal adjustment (Table 3).

Thirteen patients in the T group reported reduced subjective symptoms overall at follow-up, compared with only five patients in the C group. The changes were statistically significant within the T group ($p = 0.021$) and between the T and C group ($p = 0.009$) (Table 4).

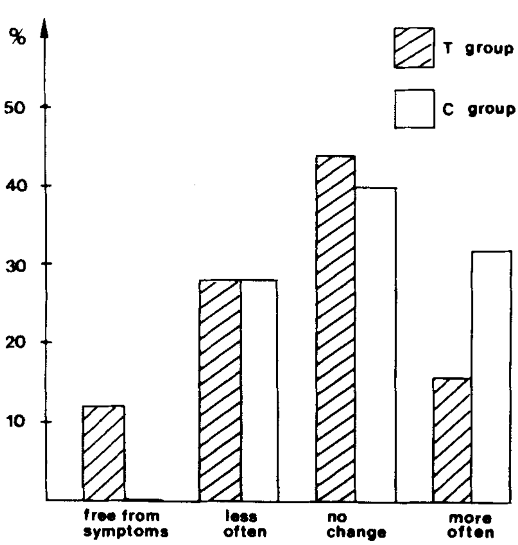

Fig. 2. Percentage distribution of changes in frequency of headaches at follow-up in the treatment (T) and control (C) groups. Diff. T–C, $p = 0.173$.

Changes in frequency of headaches and facial pain at follow-up are shown in Figs. 2 and 3. No statistically significant differences were found regarding these changes. Pain during mandibular movements did not show any significant change within or between groups at the follow-up examination.

In the T group there was a decrease of the median VAS value from 64 to 50 mm after treatment. Corresponding values for the C group were 59 and 61 mm. The changes in VAS value within and between the groups were not statistically significant.

A tendency towards significance was noted between groups at follow-up ($p = 0.078$). However, if tenderness to palpation was registered only when a palpebral reflex was evoked or a clear difference in pain between sides was present, a statistically significant difference between groups at follow-up was found ($p = 0.006$) (Fig. 4).

The changes in maximal voluntary opening capacity and clinical dysfunction score at follow-up were not statistically significant. There was no significant correlation between changes in number of tender muscles or clinical dysfunction score versus changes in frequency of headaches between visit I and III.

Discussion

The patients in this study were selected in accordance with certain criteria to sample a homogeneous group of patients with cranio-

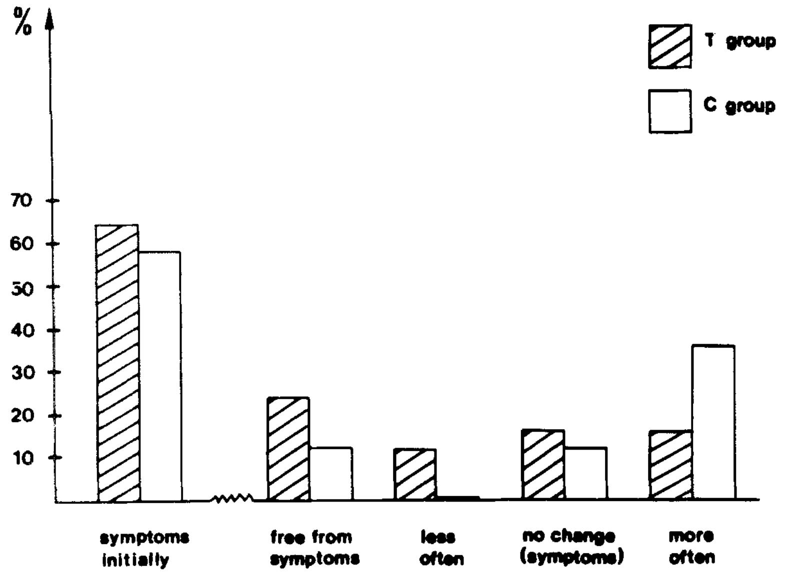

Fig. 3. Percentage distribution of changes in frequency of facial pain at follow-up in the treatment (T) and control (C) groups. Diff. T-C, $p = 0.062$.

mandibular disorders and occlusal interferences. This subgroup (3.2%) became surprisingly small compared with the original series of patients, most probably owing to the heterogeneity of the patient population with craniomandibular disorders (1, 2).

The patients in both groups in this study were treated identically except for occlusal adjustment in the T group. Information and counseling, which also have a therapeutic effect (6), were given initially to all patients and should therefore not influence the results of this study. The information given also presented occlusal adjustment and reassurance as two different therapeutic approaches for treatment of craniomandibular disorders.

A reduction in the severity of subjective symptoms as expressed by the six-graded scale was found within the treatment group, which was superior to that found in the control group. No such reduction was found for VAS, which might be explained by the fact that experience of pain is very subjective, and attempts to quantify pain are difficult (11). It is probably easier to evaluate changes in severity of pain by comparison between current and previous pain rather than to plot the pain numerically on a linear scale at different visits, especially if the initial recordings are not available at follow-up.

All patients in this study had headaches. No distinction was made between muscle contraction headaches and any other type of headache for two reasons: 1) previous medical care had not reduced symptoms sufficiently, and 2) headaches of both muscular and non-muscular origin or combination headaches seem to benefit from occlusal adjustment (14).

Three patients in the T group and none of the patients in the C group were totally relieved of headaches, although several had reductions in severity and frequency, especially in the T group. Forty per cent of the T group reported less frequent headaches after occlusal adjustment. In a study by Magnusson & Carlsson (15), in which all kinds of stomatognathic treatment were given, 69% of the patients reported less frequent headaches. The corresponding value for the control group, which received only ordinary dental care, was 28%. The controls in our study, who received no occlusal adjustment, reported the same percentage improvement as the control group in the study by Magnusson & Carlsson. These results indicate that occlusal adjustment is helpful in reducing headaches. Nevertheless, the greater reduction in frequency of headaches among the T group could be attributed to either the occlusal adjustment or a positive placebo effect. The same tendency was noted with regard to changes in frequency of facial pain and pain during mandibular movements. Several of the controls, on the other hand, had increased frequency of pain at follow-up, which is important to take into consideration when the value of occlusal adjustment is judged.

The selection criteria excluded patients with local TMJ involvement such as tenderness to palpation, crepitus, and clicking sounds associated with pain and locking. Consequently, most of the patients showed acceptable initial maximal mouth-opening capacity and did not have a large number of tender muscles, and the initial dysfunction score median values were low, 2 and 6 for T and C group, respectively. Even so, all patients had recurrent headaches, and approximately 50% reported facial pain. The correlation between frequency of headaches and number of tender muscles therefore explained only some of the headaches. Explanations for the weak correlation could be that some of the headaches might originate from other muscles, such as in the neck and upper back, or have a non-muscular origin. In addition, the correlation between changes in number of tender muscles and changes in frequency of headaches at follow-up was weak.

The two groups showed some difference in occlusal interferences before treatment. However, 1 month after the occlusal adjustment there was a marked difference concerning this factor within the T group and between groups, as could be expected. Some changes were noted also within the non-adjusted C group. These differences are explained by observer error. The remaining interferences among the T group are explained by observer error and recurrence of occlusal instability (16).

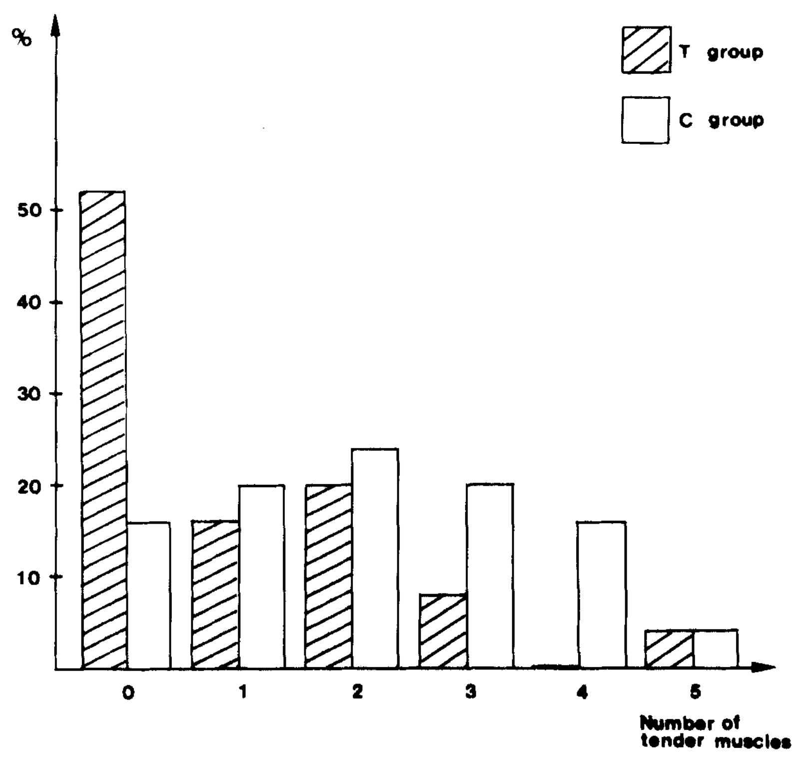

Fig. 4. Percentage distribution of number of tender muscles at follow-up for the treatment (T) and control (C) groups. Diff. T-C, $p = 0.006$.

Operator performance could not be excluded as one explaining factor for the remaining interferences. However, although the quality of the occlusal adjustment has been questioned when treatment outcome has not been successful (17), there is no conclusive scientific support for this in the literature (18).

Occlusal adjustment did not influence the clinical signs of craniomandibular disorder in this study. An explanation might be that the clinical variables registered are not sensitive or specific enough to show changes induced by treatment, as indicated by the subjective response, or the observation time may have been too short. The initial degree of clinical dysfunction was low, according to the clinical dysfunction score in both groups, corresponding to the index value of I, which may indicate a too low sensitivity of the index for this purpose.

The short-term effect of treatment on subjective symptoms of craniomandibular disorders has generally been reported to be good (19, 20). It should be noted, however, that there is often a discrepancy between clinical signs and subjective symptoms and that signs of craniomandibular disorders are commoner than subjective symptoms in the population (21). The need for treatment is mainly determined by the severity of the experienced symptoms, and evaluation of treatment effect should therefore be based at least partly on the effect on these symptoms.

The results of this study indicate that occlusal adjustment in the short term reduces subjective symptoms. If the patient's evaluation of symptoms is taken as a measure of the result of treatment, occlusal adjustment is a treatment alternative for craniomandibular disorders.

References

1. Greene CS, Lerman MD, Sutcher HD, Laskin DM. The TMJ pain dysfunction syndrome: heterogeneity of the patient population. J Am Dent Assoc 1969;79:1168–72.
2. Speck JE, Zarb GA. Temporomandibular pain-dysfunction: A suggested classification and treatment. J Can Dent Assoc 1976;42:305–10.
3. Helöe B. Demand and need for treatment of myofascial pain-dysfunction (MPD) syndrome [Thesis]. Oslo: University of Oslo, 1980.
4. Kirveskari P, Alanen, Jämsa T. Association between craniomandibular disorders and occlusal interferences. J Prosthet Dent 1989;62:66–9.
5. Ramfjord SP. Dysfunctional temporomandibular joint and muscle pain. J Prosthet Dent 1961;11:353–74.
6. Kopp S. Short-term evaluation of counselling and occlusal adjustment in patients with mandibular dysfunction involving the temporomandibular joint. J Oral Rehabil 1979;6:101–9.
7. Zarb GA, Thompson GW. Assessment of clinical treatment of patients with temporomandibular joint dysfunction. J Prosthet Dent 1970;24:542–54.
8. Beemsterboer PL, Solberg WK, Rugh JD. Occlusal splint therapy: nocturnal electromyographic response and symptom improvement [Abstract 159]. J Dent Res 1976;55B:101.
9. Goodman P, Greene CS, Laskin DM. Response of patients with myofascial pain-dysfunction syndrome to mock equilibration. J Am Dent Assoc 1976; 92:755–8.
10. Greene CS, Laskin DM. Splint therapy for the myofascial pain-dysfunction (MPD) syndrome: a comparative study. J Am Dent Assoc 1972;84:624–8.
11. Bond MR. The measurement of pain. Its nature, analysis and treatment. Edinburgh: Churchill Livingstone, 1979:27–30.
12. Helkimo M. Studies on function and dysfunction of the masticatory system. II. Index for anamnestic and clinical dysfunction and occlusal state. Swed Dent J 1974;67:101–21.
13. Vallon D, Nilner M, Kopp S. Assessment of occlusal interferences. J Oral Rehabil 1989;16:279–86.
14. Forsell H, Kirveskari P, Kangasniemi P. Changes in headache after treatment of mandibular dysfunction. Cephalalgia 1985;5:229–36.
15. Magnusson T, Carlsson GE. Changes in recurrent headache and mandibular dysfunction after various types of dental treatment. Acta Odontol Scand 1980;38:311–20.
16. Hellsing G. Occlusal adjustment and occlusal stability. J Prosthet Dent 1988;59:696–702.
17. Dawson PE. Evaluation, diagnosis and treatment of occlusal problems. St. Louis: The CV Mosby Co, 1974.
18. Clark GT, Adler RC. A critical evaluation of occlusal therapy: occlusal adjustment procedures. J Am Dent Assoc 1985;110:743–50.
19. Cohen SR. Follow-up evaluation of 105 patients with myofascial pain dysfunction syndrome. J Am Dent Assoc 1978;97:825–8.
20. Thomson H. Temporomandibular joint problems. Br Dent J 1961;11:422–3.
21. Mejersjö C, Carlsson GE. Long-term result of treatment for temporomandibular joint-pain dysfunction. J Prosthet Dent 1983;49:809–15.

Received for publication 11 January 1990