

Treatment Outcome in Patients with Craniomandibular Disorders of Muscular Origin: A 7-Year Follow-up

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The outcome of different treatment modalities after 7 years was investigated in a selected group of 50 patients with craniomandibular disorders of muscular origin. To minimize the possible effects of selection on the clinical material, the selected treatment group was compared to a consecutive group of patients in terms of age, gender, intensity/duration of pain, and socioeconomic profile. Both groups were comparable in most respects, but the selected group had a longer duration and a higher intensity of pain at baseline. There were more men in the consecutive group than in the selected group. A combined treatment approach resulted in a better outcome than single treatments. Sixty-five percent of all patients in the selected group reported improvement at the 7-year follow-up. All of the 19 patients who received counseling combined with different occlusal treatments improved. Forty-three percent of the patients treated otherwise showed improvement. Patients who were aware of stress responded better to treatment.

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Based on the idea that the etiology of craniomandibular disorders (CMDs) is multifactorial,^{1,2} various single or combination treatment modalities have been performed with favorable outcomes.²⁻⁴ Systematic evaluations of different modalities have been infrequent; when presented, these evaluations have shown few differences among methods that would substantiate an advantage of one modality over others. For example, occlusal treatment alone and in combination with other modalities has been shown to be effective in reducing CMD symptoms.⁵⁻⁷ An explanation for this is that different methods have similar effects on the reduction of muscular tension related to psychologic stress.⁸

Many CMD patients have been successfully treated with occlusal adjustment, different occlusal appliances that change the occlusal position, jaw exercises, information and counseling, and biofeedback training. Other treatments include physical therapy, medications, and local intramuscular or intra-articular injections of corticosteroids or anesthetics. Orthodontic and prosthetic treatment may be needed to establish physiologic occlusion after CMD problems have been resolved.^{2,9}

Some studies have shown that the long-term prognosis of most CMD patients is good. A 70% success rate has been reported for patients treated conservatively.^{10,11} A few longitudinal studies have evaluated specific diagnostic groups while simultaneously

analyzing the effect of one treatment method for each group.^{5,12,13} Other studies have reported that some successfully treated patients had recurrent dysfunctions and required different additional treatments.^{10,11} For example, Mejersjö and Carlsson¹⁰ found that 10 to 20% of patients who were initially treated successfully had persistent symptoms, and approximately 14% required additional treatment over a 7-year period. Based on clinical experience, some investigators have agreed that certain patients will not improve irrespective of treatment.^{3,13,14} Impaired general health and social, economic, and psychologic problems are more common among therapy-resistant patients.¹¹

In previous controlled prospective studies of selected CMD patients, the treatment effect of occlusal adjustment has been compared with the effect of information and counseling over a 2-year period.¹⁵⁻¹⁷ The aims of the current study were: (1) to evaluate the treatment outcome of combined conservative treatment modalities in a selected group of patients in a 7-year follow-up and (2) to determine if this selected group differed from a consecutive group of patients in terms of gender, age, intensity/duration of pain, and socioeconomic variables.

Materials and Methods

Patients

Sixty-four patients were selected from those referred to the Department of Stomatognathic Physiology at the Faculty of Odontology in Malmö, Sweden from August 1985 to October 1988. Of these patients, 50 were diagnosed with muscular CMD based on: patient history; clinical evidence of pain on palpation, pain on movement, etc; and the diagnostic criteria for muscular CMD outlined by Okeson.²

Inclusion criteria included natural dentition or fixed prosthodontics with at least premolar support, and the presence of occlusal interferences. Functional occlusal relationships were classified as interferences when one or more of the following were present: unilateral contacts in retruded contact position (RCP); bilateral contacts in RCP causing an asymmetric slide between RCP and intercuspal position; predominant posterior contacts on the working side; balanced occlusal contacts causing disclusion of the working side; and predominant posterior contacts during protrusive movement of the mandible. Exclusion criteria included clinical evidence of systemic joint or

Table 1 Gender and Age of Patients in the Selected (T + C) and Consecutive (Cc) Groups at the Beginning of the Investigation

	T + C group			Cc group		
	Age (y)			Age (y)		
	n	Median	Range	n	Median	Range
Men	6	30	19-46	15*	36	3-73
Women	44	28	15-55	38	42.5	15-78
Total	50	28.5	15-55	53	42	3-78

*Men were more frequently represented in the Cc group than in the T + C group ($P = 0.0459$).

muscular disorders, and temporomandibular joint (TMJ) pain, painful clicking, crepitation, and disc displacement without reduction or tenderness on palpation of the TMJ.

The 50 patients, 44 women and 6 men, were randomly assigned to a treatment (T) or control (C) group. Both groups were informed about their diagnosis and reassured about the benign character and good prognosis of CMD. Both groups were counseled regarding oral parafunctions, chewing habits, and oral and stress behaviors. In addition to counseling, the T group received occlusal adjustment at the beginning of the treatment period. The treatment outcome for both groups had been followed in a 2-year study.¹⁷ Because of negative treatment outcomes, some patients demanded treatments other than those of the original treatment plan. When all modalities were included, a positive outcome was reported by 70% of the T group patients and 79% of the C group patients. Because they were similar, the outcomes for both groups were pooled (T + C). Patients who demanded "rescue" treatment (additional treatment differing from that of the original treatment plan) were considered unsuccessfully treated with respect to counseling and occlusal adjustment. They were followed for the entire follow-up period, and the different modes of rescue treatment were evaluated. Details about these patients have been published elsewhere.¹⁵⁻¹⁷

Fifty-three consecutive patients from the Department of Stomatognathic Physiology at Lund University in Malmö, Sweden were assigned to a consecutive (Cc) group. There were no inclusion criteria other than consecutive admission. Gender and age distributions for the T + C and Cc groups are presented in Table 1.

Questionnaire

Seven years after the initial treatment of the T + C group, a self-administered questionnaire was mailed to the patients. One patient declined to reply. Approximately 2 weeks after the questionnaire was mailed, the remaining patients (those who had not responded to the questionnaire or whose responses were incomplete) were interviewed by telephone. Patients were asked about ethnicity, family situation, occupation, and education. They were also asked if they had received rescue treatment from the university's Department of Stomatognathic Physiology and/or a community medical office. Their responses indicated that they had undergone a variety of rescue treatments, including biofeedback training, medication, physiotherapy, massage, transcutaneous nerve stimulation, acupuncture, medical advice/treatment, zone therapy, and chiropractic. Patients who had received only occlusal therapy (occlusal adjustment and/or occlusal appliance) were considered low treatment consumers, and patients who had received additional individual or combined treatments were considered high treatment consumers.

Patients in the T + C group were asked to evaluate their treatment outcome by means of a graded scale that rated overall symptoms as: free from symptoms, much better, slightly better, unchanged, worse, or much worse. Overall subjective improvement was considered to have occurred when patients reported themselves symptom-free, much better, or slightly better. The intensity of overall symptoms, expressed as a most often-experienced pain, was assessed on the visual analogue scale (VAS).¹⁸ The severity of present symptoms was compared to the initial symptoms by means of self-evaluation. Symptoms were rated better, unchanged, or worse. Patients were asked if their daily life was affected by their symptoms, why pain and discomfort started, and if they had actively tried to influence their pain and discomfort.

Patients in the Cc group completed the same kind of questionnaire dealing with age, gender, socioeconomic status, and symptoms. Their pain was also assessed by a VAS.

Statistical Methods

Changes in symptoms between initial and follow-up visits were tested for significance with Wilcoxon's matched-pairs signed rank test for variables measured on an ordinal scale. Differences between groups were tested for significance by Chi-square

Table 2 Distribution of Selected Socioeconomic Variables and Mean Duration and Intensity of Pain Among the T + C and Cc Groups

	T + C group (n = 49)	Cc group (n = 53)
Ethnicity		
Foreign nationality	11	15
Family situation		
Married	30	20
Single	16	21
Divorced	3	8
One-person household	8	5
Unemployment		
Temporary/permanent	15	21
Education		
High school or higher education	42	34
Intensity of pain (VAS)		
Mean (mm)	53*	37
Median (mm)	62*	33
Duration of pain		
≥ 1 year	40*	30

*The T + C group reported more intense pain ($P = 0.0065$) and a longer duration of pain ($P = 0.0436$) than the Cc group.

analysis. P values were considered significant at $P < 0.05$. Associations between variables were tested by multiple regression.

Logistic regression analysis was used to assess reported overall symptoms in relation to different independent variables. This analysis allowed multivariate analysis of dichotomous dependent variables by transformation of the dependent into a probability statement, a so-called logit transformation. Logit values were calculated to produce probability assessments for various compared variables.¹⁹ The Statistical Package for the Social Sciences (SPSS) was used.

Results

There were no statistically significant differences between the T + C group and the Cc group regarding ethnicity, family situation, unemployment, and education (Table 2). There were more men in the Cc group than in the T + C group (Table 1, $P = 0.0459$). The T + C group reported more intense pain initially ($P = 0.0065$) and a longer duration of pain ($P = 0.0436$) than the Cc group (Table 2).

After 7 years, 5 of the 25 patients in the T group (counseling/occlusal adjustment) had had no further

Table 3 Number of Patients in the T + C Group Who Improved with Different Therapies, Recorded During a 7-year Follow-up

Treatment	No. of patients seeking treatment (n = 50)	No. of patients who improved
Counseling	2	1
Counseling and occlusal adjustment	7	7
Counseling and occlusal adjustment and/or appliance	12	12
Counseling and other treatment* only or combined with occlusal adjustment and/or appliance	28	12
Total	49 [†]	32

*Other treatment includes medical treatment/advice, biofeedback training, drug therapy, massage, transcutaneous nerve stimulation, acupuncture, zone therapy, chiropractic, homeopathy, health center programs, behavioral therapy, and psychotherapy.

[†]One patient did not participate in the 7-year follow-up.

Table 4 Number of Patients in the T and C Groups Who Demanded Rescue Treatment at Follow-ups

Follow-up	Patients demanding rescue treatment		
	T group (N = 25)	C group (N = 25)	T + C group (N = 50)
1 mo	0	0	0
3 mo	3	7	10
6 mo	6	8	14
2 y	3	6	9
7 y	8	2	10
Cumulative frequency (n)	20	23	43

N = number of patients at baseline.

Table 5 Treatments Received, in Order, by Individuals Who Did Not Report Improvement After 7 Years

Patient No.	Rescue treatment*						
	Occlusal adjustment	Occlusal appliance	Drug therapy	Physical therapies	Zone therapies	Medical treatment/advice	Other treatment [†]
1	1	4	–	2	7	5	3,6,8
2	1	2	–	4	–	3	–
3	1	5	–	7	2	6	3,4,8,9
4	1	–	–	3	–	2	4,5
5	1	4	–	5	–	3	2,6,7
6	1,3	2	–	6	–	5	4,7
7	1	2	–	–	4	3	–
8	1	2	–	–	–	3	–
9	1	–	–	–	–	–	2
10	1	–	–	–	–	2	–
11	1	4	2	6	7	5	3,8,9
12	2	1	–	6	3	5	4
13	–	–	2	–	–	1	–
14	–	1	2	3	–	4	5,6
15	3	2,4	–	1	5	–	6
16	–	–	1	3	–	2	4,5

*Number indicates order in which treatment was sought.

[†]Other treatment includes biofeedback training, massage, transcutaneous nerve stimulation, acupuncture, chiropractic, homeopathy, health center programs, behavioral therapy, and psychotherapy.

treatments; 2 of the 24 patients in the C group (counseling only) had had no further treatments. All other patients had requested some form of rescue treatment (Table 3). The number of patients who demanded rescue treatment at different follow-up visits is presented in Table 4.

When all treatments for the T + C group were considered, 65% of the patients reported improvement (Table 3). Nineteen of 19 patients who received

counseling combined with occlusal treatment improved. Twenty of 21 patients improved after either counseling alone (1 out of 2) or counseling combined with occlusal treatment (19 out of 19). Forty-three percent of the 28 remaining patients who requested treatment beyond counseling/occlusal treatment improved; 16 of the 17 other patients who did not improve demanded other treatments (Table 5). Overall, 32 patients found their last treatment

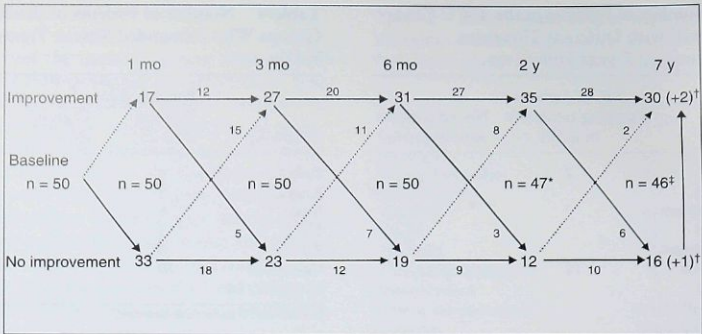


Fig 1 Patients who reported improvement at the 7-year follow-up versus patients who did not report improvement. (*Three patients did not attend the 2-year follow-up visit. [†]Patients who did not attend the 2-year follow-up visit. [‡]One patient did not participate in the 7-year follow-up.)

Table 6 Development of Subjective Symptoms, Intensity of Pain, and Clinical Signs in the T + C Group After Other Treatments

No. of patients	Baseline	Follow-up				
		1 mo (n = 50)	3 mo (n = 50)	6 mo (n = 50)	2 y (n = 47)	7 y (n = 49)
Improvement (%)						
Overall	–	38	54	62	74	65
Headache	–	34	38	56	70	67
Facial pain*	–	43	50	61	61	63
VAS (mm)						
Median	60	57.5	47.5	32	26	
Range	0–100	0–100	0–99	0–99	0–100	
Maximal opening capacity (mm)						
Median	51	51.5	51	51	53	
Range	37–66	35–69	39–65	39–62	30–71	
Pain on mandibular movement (%)	38	40	24	30	12	
TMJ clicking and/or deviation > 2 mm on opening (%)	56	56	62	48	60	
Tenderness of masticatory muscles (%) [†]	74	78	74	70	65	

*At baseline only 16 patients in the T group and 12 patients in the C group reported facial pain.
[†]Tenderness in one or more of the following groups of muscles: insertion, anterior, and posterior belly of the temporal muscle; deep and superficial portion of the masseter muscle; inferior belly of the lateral pterygoid muscle; and the medial pterygoid muscle and the posterior belly of the digastric muscle.

useful. The median number of treatments was six for patients who had not improved after 7 years and three for those who had improved (Fig 1).

For the T + C group, 67% of the patients reported that they were better or symptom-free in terms of frequency/intensity of headache at the 7-year follow-

up. Sixty-three percent of the patients who initially had facial pain reported improvement after 7 years.

Table 6 presents the symptoms that developed and certain clinical variables determined after treatment at each follow-up. A statistically significant association was found after 7 years between the

Table 7 Believed Causes of Initial Pain According to Patients in the T + C Group

Believed cause of pain	Patients	
	(%)	n
No idea	24	12
Stress	47	23
Work-related problems	20	10
Illness of relatives	12	6
Death of relatives	1	4
Problems with relatives	16	8
Previous dental treatment	10	5
Disturbances in occlusion	12	6
Previous trauma	0.4	2
Other*	0.6	3

*Posture/constitution n = 2; sleep disturbances n = 1.

Table 9 Patient Estimation of the Kind of Treatment That Was Most Helpful for Pain/Discomfort

Treatment	Patients		
	(%)	n	N
Counseling	20	10	2
Occlusal therapies			
Occlusal adjustment	24	12	5
Occlusal appliance	31	15	6
Physical therapies			
Relaxation	12	6	1
Physiotherapy	14	7	1
Medical treatment/advice	16	8	5
Other treatments			
Acupuncture	4	2	
Zone therapy	4	2	
Chiropractic	2	1	1
Health center program	4	2	2
Behavioral therapy	2	1	1
Psychotherapy	2	1	

verbal scale used to describe the development of symptoms and the VAS intensity of pain. The 65% of patients who reported improvement had lower VAS scores ($P = 0.0027$) than the patients who failed to improve. When improvement was defined as symptom-free or much better, 56% of the patients improved ($P = 0.0008$).

The multiple regression analysis also confirmed an association between VAS intensity of pain and reported improvement. Patients who reported improvement on the verbal scale had significantly lower VAS scores (20 mm) than patients who failed to improve ($P = 0.0030$). The regression model explained 15% of the variance in the dependent variable according to the Adjusted R Square. As a whole, the analysis was significant

Table 8 Impact of Actual Pain on Daily Life Situations Reported by Patients in the T + C Group

Impact of actual pain	Patients	
	(%)	n
Not at all	2	1
Affects my temper	47	23
Worries me a lot	27	13
Affects my work	24	12
Disturbs my sleep	33	16
Must take sick leave	10	5
Must take medicine	24	12
Worries me a little	65	32

n = number of T + C group patients.

Table 10 Multiple Logistic Regression Model with Development of Overall Subjective Symptoms as Dependent Variable*

Independent variable (measurement unit)	Regression coefficient	Odds ratio	P value [†]
Gender (female)	2.77	15.95	0.0604
Age (year)	-0.13	0.88	0.0449
Marital status (married)	1.50	4.50	0.2196
Education (high)	0.32	1.38	0.8008
Stress (yes)	2.96	19.29	0.0254
Duration of symptoms (≥ 1 year)	-0.18	0.84	0.8856
Intensity of pain (VAS)			
Treatment consumption (high)	-5.18	0.01	0.0033

-2LL = 31,250; Chi-square model = 32,859, 8df; $P = 0.0001$; correctly predicted cases = 91.5%.

*"Symptom-free" or "much better" = 1; other = 0.

[†] $P < 0.05$ was considered significant.

($F = 5.2$, 2 df; $P = 0.0095$). Another regression analysis of age, gender, nondental treatment, group, education, marital status, duration of symptoms, and development of symptoms was conducted, but its results were not statistically significant. The relation between VAS and the verbal scale was, however, maintained in this analysis ($P = 0.0240$).

Most patients had one or more beliefs about what initiated the pain/discomfort (Table 7). Stress and/or stress-related events were the most common reported beliefs. Few patients reported occlusal problems.

Activities of daily living were affected by the actual pain in different ways and to different degrees (Table 8). Although 32 patients reported

little impact of pain on daily life, half of these patients reported pain to have one or more areas of impact. Approximately two thirds of the patients actively tried to influence their pain either by changing their behavior or by modifying their environment.

All patients reported the treatment that was most helpful in the management of their pain/discomfort (Table 9). Sixty-nine percent (22/32) of the patients who had a positive outcome reported that either occlusal therapies or information and counseling were the most helpful treatments.

The effect of independent variables on treatment outcome was subjected to multiple logistic regression analysis (Table 10). Although the units used for measurement differed, the covariation with age held for each additional year as the VAS odds ratio held for every millimeter on the VAS scale. The chances for reporting improvement indicated by the odds ratio were 19 times higher for patients who reported more stressful events compared with those who reported fewer stressful events ($P = 0.0254$). Each variable (age, mean intensity of pain, and kind of treatment) contributed to treatment outcome both separately and with control for other variables. The probability of patients reporting improvement increased by 4.8% for each millimeter decrease in VAS score ($P = 0.0377$). The covariation between self-rated improvement and high treatment consumption proved strongly negative.

Discussion

Seventy-six percent of the patients in the current study demanded more than one treatment in addition to information and counseling. This finding regarding high treatment consumers concurs with the findings of another study conducted on patients with muscular CMD. Compared with other diagnostic subgroups, 67% of muscular CMD patients required renewed treatment, had the least successful treatment outcome, and had the highest percentage of residual complaints.²⁰

The finding that 65% of our patients improved after 7 years could be interpreted as a successful treatment outcome. A combined treatment approach of counseling and occlusal appliance has proven effective in a study of another group of consecutive TMJ patients, in terms of treating both pain and depression.⁴

The less favorable outcome among myogenous patients has been explained by the conclusion that they are more psychologically distressed than arthrogenous patients.^{21,22} Most of our patients

reported several believed causes of initial pain/discomfort. Stress was the most commonly reported belief. Although it is difficult to assess their impact, the information and counseling given to our patients likely influenced their responses and contributed to successful treatment outcome.

The VAS scores showed that high treatment consumers had a higher probability of non-improvement than low treatment consumers who received only occlusal treatment and counseling. The strength of this association dominates the other variables as shown by the high regression coefficient. Patient awareness of stress seemed to have a beneficial influence on the alleviation of symptoms. The finding that the more treatment received, the worse the outcome may appear contradictory; however, there is a covariant rather than a causal relationship: the worse a patient feels, the more treatment is demanded and received, and not the reverse. Fluctuations in symptoms accounted for the failure of some patients to maintain improvement over the 7-year period. Similar findings have been reported in other longitudinal clinical studies.⁵⁻⁷

Some of the differences between the T + C and Cc groups might be explained by the restricted inclusion criteria applied for the T + C group. They were a selectively chosen group, while the Cc group were consecutive patients. The duration of pain had no influence on treatment outcome according to the logistic regression model (Table 10). This finding contrasts with the findings of another study conducted by Wedel and Carlsson,¹¹ who bivariately found that a long duration of symptoms may have a negative influence on treatment outcome. These studies are not directly comparable because our study sample consisted only of muscular CMD patients; the previous study included other diagnostic subclasses.

The small number of patients in the current study limits our interpretations. Two variables, development of overall symptoms and duration of pain, were divided for maximum discrimination. These variables were also divided according to the standards used for evaluation of clinical materials (improvement = symptom-free, much better, or slightly better; low duration of symptoms ≤ 6 months). The choice of cut-off points had a negligible influence on the results, which only strengthens the conclusions of our study.

The T + C group was chosen very selectively. For this reason it was of interest to compare this group with a consecutive group of patients regarding some background variables. The T + C and Cc groups were comparable in age and socioeconomic profile.

Men were more common in the Cc group than in the T + C group, although still in a frequency normally found in clinical studies.^{7,23} The single difference between the two groups concerned pain. Initially, the T + C patients reported a significantly longer duration of pain and a higher intensity of VAS pain than the Cc group. Patients with muscular CMD have been reported to perceive more generalized facial pain of longer duration than arthrogenous CMD patients.²² In the same study, muscular CMD patients rated their "pain at its worst" significantly higher than arthrogenous CMD patients. A possible explanation for the lower VAS scores of our Cc group is that other diagnostic subclasses were represented in the sample. Muscular CMD occurred in just 32% of all patients.

Future longitudinal studies should include a larger sample of patients with muscular CMD. Although difficult to obtain, only patients who have received no prior treatment should be included in the investigation.

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Resumen

Resultados del Tratamiento en Pacientes con Desórdenes Craneomandibulares de Origen Muscular: Seguimiento de 7 Años de Duración

Se investigaron los efectos de diferentes modalidades de tratamientos después de 7 años en un grupo seleccionado de 50 pacientes con desórdenes craneomandibulares de origen muscular. El grupo de tratamiento seleccionado fue comparado a un grupo consecutivo de pacientes en relación a la edad, género, intensidad y duración del dolor, y perfil socioeconómico, para aminorar los posibles efectos de selección en el material clínico. Ambos grupos fueron comparables en la mayoría de los casos, pero el grupo seleccionado presentaba un dolor cuya duración e intensidad eran mayores al principio. Habían más hombres en el grupo consecutivo, que en el grupo seleccionado. El tratamiento combinado resultó ser mejor que los tratamientos individuales. El 65% de todos los pacientes en el grupo seleccionado reportaron mejorías en los exámenes de seguimiento de los 7 años. Todos de los 19 pacientes que recibieron consultas de asesoramiento combinadas con tratamientos oclusales diferentes mejoraron. El 43% de los pacientes tratados de otra manera mostraron mejoría. Los pacientes que estaban informados sobre el estrés respondieron mejor al tratamiento.

Zusammenfassung

Behandlungsergebnis bei Patienten mit Craniomandibulären Erkrankungen Muskulären Ursprungs: Eine 7-Jahres Nachkontrolle

Das Ergebnis verschiedener Behandlungsmodalitäten nach 7 Jahren wurde in einer ausgewählten Gruppe von 50 Patienten mit craniomandibulären Erkrankungen muskulären Ursprungs untersucht. Um die möglichen Auswirkungen der Auswahl auf das klinische Material zu minimieren wurde die ausgewählte Behandlungsgruppe mit einer konsekutiven Gruppe in Bezug auf Alter, Geschlecht, Intensität, Schmerzdauer und sozioökonomisches Profil verglichen. Beide Gruppen waren in meiste Hinsicht vergleichbar, aber die ausgewählte Gruppe hatte zu Beginn eine längere Schmerzdauer und eine höhere Schmerzintensität. Es waren mehr Männer in der konsekutiven Gruppe als in der ausgewählten Gruppe. Eine kombinierte Behandlungsmethode führte zu besseren Ergebnissen als einzelne Behandlungen. Fünfundsechzig Prozent aller Patienten in der ausgewählten Gruppe berichteten bei der 7-Jahres-Nachkontrolle über eine Verbesserung. Neunzehn Patienten, die Beratung mit verschiedenen okklusalen Therapien erhielten, verbesserten sich. Dreiundvierzig Prozent der Patienten, welche auf andere Weise behandelt wurden, zeigten eine Verbesserung. Patienten, die sich des Stresses bewusst waren, sprachen besser auf die Behandlung an.

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