

Effects of occlusal treatment and intra-articular injections on temporomandibular joint pain and dysfunction

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The long-term effect (2 years) of occlusal treatment and intra-articular injections of a mixture of corticosteroid and local anaesthetic was investigated in two groups of patients with pain and dysfunction in the temporomandibular joint (TMJ). Fifteen patients were treated with injections and eighteen patients with occlusal adjustment. The TMJ was tender to palpation in all patients. The intra-articular injections were given once a week for three weeks. The occlusal treatment included splints, grinding of natural teeth and occlusal correction of complete dentures. The severity of the subjective symptoms and clinical signs was estimated before and after treatment. Both sorts of treatment reduced the subjective symptoms and the clinical signs significantly, but the reduction was significantly greater after the intra-articular injections. The effect of the injections was less efficient in patients with radiographic signs of remodelling of the TMJ and general joint symptoms. It was concluded that both intra-articular injections of corticosteroid combined with local anaesthetic and occlusal treatment have a long term palliative effect on TMJ pain and dysfunction. The intra-articular treatment, however, had a greater effect on the clinical signs.

Key-words: Mandibular dysfunction; intra-articular injections; corticosteroids; local anaesthetic; occlusal adjustment

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Intra-articular injections of corticosteroids into the temporomandibular joint (TMJ) have been advocated in patients with severe contusion and edema of the joint following acute trauma, in patients with acute synovitis secondary to osteo-arthritis and in patients with acute exacerbations of rheumatoid arthritis (4). Their use can only be recommended when the joint is the primary pain site (20) and in adult patients.

The short-term effect (4 months) of counselling, occlusal adjustment and intra-articular injections of a mixture of corticosteroid (betamethasone) and local anaesthetic (lidocain-chloride-anhydride) in patients with pain and dysfunction localized to the TMJ has been reported previously (10, 18). The subjective symptoms were reduced significantly after counselling but no effect on the clinical signs was found. Af-

ter occlusal adjustment the clinical signs were moderately reduced. The palliative effect of the intra-articular injections was substantial on both the subjective symptoms and clinical signs.

The aim of this study was to investigate and compare the long-term effects of the intra-articular injections and the occlusal treatment in patients tender to palpation of the TMJ.

The etiology of pain and dysfunction in the stomatognathic system is heterogeneous (5, 7) and it is therefore of great interest to obtain information about which treatment is the most effective in different subgroups of patients.

MATERIAL AND METHODS

Selection of patients

All patients included in this study were selected from patients treated at the Department of Stomatognathic Physiology, University of Göteborg (Table 1).

Intra-articular injections

15 patients (13 women and 2 men) were selected for this treatment during the years 1976–1977 (18). The criterion for acceptance was local pain and tenderness to palpation of the TMJ. All patients in this group had experienced a previous failure of conservative treatment (counselling, occlusal grinding, occlusal splints, and/or physical exercises). General (diabetes mellitus, Cushing's syndrome, peptic ulcer) and local (infection) contra-indications to this treatment were also considered in the selection of the patients. None of the patients were receiving general corticosteroid treatment.

Occlusal treatment

18 patients (16 women and 2 men) were selected for this treatment from a consecutive series of patients referred to the clinic because of mandibular pain and dysfunction during 1973 (10). Those patients who had local pain and tenderness to palpation of the TMJ were included in the present study. Patients below 16 years of age, patients with symptoms caused by major trauma or surgery and patients with verified systemic disease involving joints or muscles had been excluded initially.

The duration of symptoms from the masticatory system and the presence of general joint symptoms in both groups are given in Table 1.

Treatments

Intra-articular injections

A mixture of 0.5 ml of betamethasone (Celestona bifas®, 6 mg/ml) and an equal amount of lidocain-chloride-anhydrate (Xylocain®, 10 mg/ml) were given once a week for three weeks. The long-term effect of this treatment was assessed after 2 years. All the patients in this group were examined and treated by one of two examiners, the same one on each occasion.

Occlusal treatment

Six weeks after counselling (i.e. information about the probable cause and good prognosis of the symptoms) and advising the patient to chew carefully (avoid tough food and painful movements), occlusal adjustment was performed, in one of the following three ways, according to principles followed at the Department of Stomatognathic Physiology in Göteborg (1, 12):

Occlusal splints affording molar support, if needed, were given to 16 pa-

Table 1. Distribution by sex, age, duration of TMJ-complaints, general joint symptoms, radiographic changes of the TMJ and measures of the subjective and clinical dysfunction score (baseline I and final score II)

Sex		Age		Duration of TMJ-sympt. (years)		General joint symptoms		Radiographic changes		Subjective dysfunction				Clinical dysfunction			
C	O	C	O	C	O	C	O	C	O	C		O		C		O	
										I	II	I	II	I	II	I	II
M	M	42	48	5/12	MD	+	+	E	D	4	2	5	3	12	4	3	6
M	M	59	57	2	2	+(RA)	-	MD		4	1	3	1	17	8	8	3
F	F	19	19	1	5	-	-	E		4	1	4	3	20	8	2	6
F	F	23	23	4/12	MD	-	+	MD	D	4	2	4	3	16	4	2	12
F	F	24	24	5	4	+(RA)	+	D		5	3	5	1	17	9	1	5
F	F	27	25	2	6	-	-		D	4	3	4	1	16	2	8	7
F	F	28	27	2	3	+(RA)	-	E		5	2	3	4	12	3	8	4
F	F	32	30	2	6	-	+			4	1	4	2	17	0	7	6
F	F	32	30	6/12	3	+	-	E	E	4	2	4	1	16	2	7	1
F	F	36	43	2	5	+	+	D		4	3	3	2	8	6	3	6
F	F	41	50	5	MD	-	+			4	2	2	1	16	1	15	11
F	F	44	52	4/12	6	-	+	MD		4	1	3	3	12	0	12	8
F	F	48	55	5	2	+	+		D+E	4	3	4	4	13	8	12	11
F	F	49	59	5	3	+(RA)	-	D		4	4	4	2	13	8	13	7
F	F	66	62	2	2	-	-	D	D	4	1	2	3	13	7	9	7
	F		67		6		-					4	2			13	11
	F		73		4		+		D+E			5	3			13	21
	F		79		2		+		D+E			4	3			13	12

\bar{x} : 38 46 2.3 3.9 53% 56% 67% 44%
(n=15) (n=12)

C = corticosteroid treatment, O = occlusal treatment, M = male, F = female, RA = rheumatoid arthritis, E = erosions, D = deviation in shape, MD = missing data

tients. The patients were instructed to wear the splints during sleep but also during daytime, if possible. The splints were used for at least 6 weeks. Nine of these patients had occlusal interferences and were also subjected to *occlusal grinding*. The grinding was performed to eliminate unilateral premature contacts in the retruded position (RP), interferences between RP and the intercusp position (IP) causing lateral displacement of the mandible > 0.5 mm, and balancing side interferences preventing tooth contact on the laterotrusion side. The aim of the grinding was to create a bilaterally stable occlusion, within 1 mm from RP, and undisturbed lateral excursions.

Occlusal correction with self-polymerizing acrylic resin was performed in 2 patients with complete dentures. The dentures were also relined temporarily

(Coe-comfort®) and after 6 weeks permanently to improve the denture base retention and stability.

The splints and dentures were adjusted to stable occlusion in RP and approximately 1 mm anterior to it. The lateral excursions were adjusted so as not to disturb bilateral function, i.e. no mediotrusion (balancing) interferences were tolerated and at least three pairs of teeth were to have simultaneous contact on the laterotrusion side in cusp to cusp position.

The long-term results of the occlusal treatment were also assessed after 2 years. All the patients in this group were examined and treated by the same examiner.

The counselling was performed in approximately the same way for the patients in the two groups.

None of the patients in the two

groups has received any treatment of significance to the results of this study during the 2-year follow-up.

Assessment of subjective symptoms

A printed questionnaire of multiple choice type was used to assess the severity of the subjective symptoms of pain and dysfunction before and after treatment. The question was «How severe are your symptoms?». The patients were requested to choose one of the following alternative answers: 1. Minimal or no discomfort, 2. Slight discomfort, 3. Moderate discomfort, 4. Severe discomfort, 5. Very severe discomfort. The baseline data of this subjective dysfunction index are given in Table 1. The presence of general joint symptoms (recurrent stiffness, pain or swelling in other joints than the TMJ) and diagnosed joint disease was also assessed by the questionnaire.

Assessment of clinical signs

Routine methods of examination were used, including examination of tenderness to palpation of the masticatory muscles and TMJ, TMJ sounds (clicking or crepitation), maximal mandibular movements, pain during mandibular movements and deviation of the mandible during opening of the mouth (12). The severity of the clinical signs was estimated using the clinical dysfunction index devised by Helkimo (6). The clinical examination procedures used in this study have been described in detail elsewhere (10). The baseline data of the clinical dysfunction index are given in Table 1.

Radiographic evaluation

Radiographic examination of the TMJ had been performed before treatment

in all but 3 patients receiving intra-articular corticosteroid injections. The examination included ortho-pantomography, mentovertical, lateral transcranio-oblique and transmaxillary projections. The radiographic findings were classified as deviation in shape (remodelling) or erosion of mineralized tissue (osteolytic lesions, Table 1).

Statistics

Differences in subjective and clinical dysfunction score, as well as in single clinical signs, were tested by means of the Wilcoxon matched-pairs signed-ranks test (16). Pearson's product-moment correlation coefficient (r) was calculated to provide an approximate estimate of the strength of the influence of various confounding factors on the treatment effects. The significance of differences in effect between the two treatments was tested with the Mann-Whitney U-test (16). The patients were then divided into groups according to the confounding factors accounted for. The U-test variables were first calculated for each group separately and then pooled. The p-value was then calculated by means of the Z-distribution.

RESULTS

Subjective dysfunction score

Intra-articular injections

The patients' personal opinions of the severity of their symptoms at the two examinations are shown in Table 1 and Fig. 1. The mean subjective dysfunction score decreased from 4.1 to 2.1. The interindividual range of variation of the score as reflected by the standard deviation was low at examination I but had increased at examination II, reflecting the variation in subjective response to

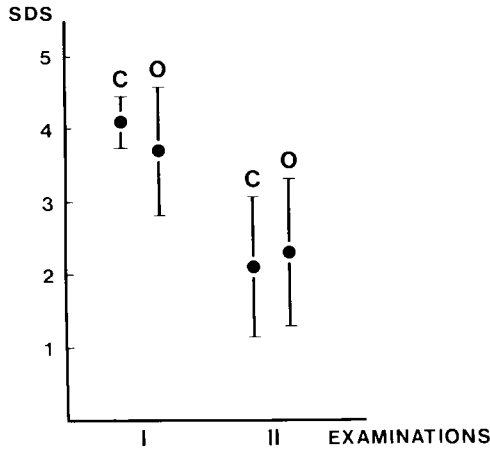


Fig. 1. Subjective dysfunction score (SDS) before (I) and after treatment (II). Mean values \pm 1 standard deviation. C = intra-articular injections, O = occlusal treatment.

the treatment. The subjective dysfunction score was reduced in 14 of the patients (93 %) and unchanged in one. The difference in score between the two examinations was statistically significant ($p < 0.01$).

Occlusal treatment

The mean subjective dysfunction score in this treatment group decreased from 3.7 to 2.3 (Table 1 and Fig. 1). The standard deviation of the score increased slightly after treatment. The subjective dysfunction score was reduced in 14 (78 %) and unchanged or increased in 4 (22 %) of the patients. The reduction of the score was statistically significant ($p < 0.01$).

Clinical dysfunction score

Intra-articular injections

The clinical dysfunction score at the two examinations is shown in Table 1 and Fig. 2. The mean dysfunction score decreased from 14.5 to 4.7 after treatment. The value of the standard devi-

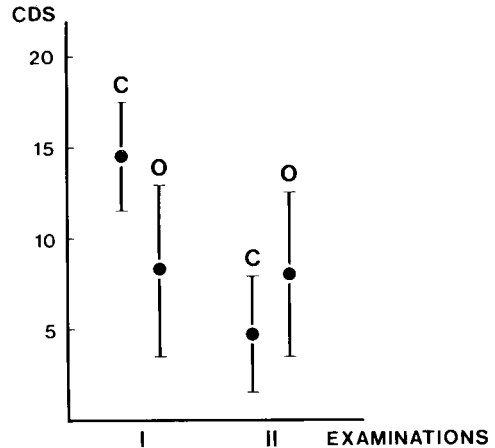


Fig. 2. Clinical dysfunction score (CDS) before (I) and after treatment (II). Mean values \pm 1 standard deviation. C = intra-articular injections, O = occlusal treatment.

ation was slightly increased. The clinical dysfunction score was reduced in all patients and the reduction was found to be statistically significant ($p < 0.01$).

Occlusal treatment

The mean clinical dysfunction score was reduced from 8.3 to 8.0 (Table 1 and Fig. 2). The standard deviation of the score was high and approximately the same at both examinations. No statistically significant reduction was obtained.

Effect on single clinical signs

Intra-articular injections

The mean value of the maximal mouth opening increased from 30.5 mm to 41.1 mm after treatment and this difference was statistically significant ($p < 0.01$). The number of masticatory muscles tender to palpation, tenderness to palpation of the TMJ and the number of painful mandibular movements decreased significantly ($p < 0.01$). No

statistically significant change could be detected for TMJ sounds (clicking or crepitation).

Occlusal treatment

The mean value of the maximal mouth opening increased from 41.1 mm to 43.7 mm and this difference was statistically significant ($p < 0.05$). Tenderness to palpation of the TMJ and the number of painful mandibular movements decreased and the reductions were statistically significant ($p < 0.05$). No significant change in the number of masticatory muscles tender to palpation or TMJ sounds could be detected.

Confounding factors

The influence on the reduction in *clinical* dysfunction score was investigated for the variables presented in Table 2.

Intra-articular injections

A statistically significant negative correlation was found between the reduction of the clinical dysfunction score and radiographic signs of deviation in shape of the TMJ ($p < 0.01$) and general joint symptoms ($p < 0.02$). The extent of the reduction in the clinical dysfunction score was positively correlated to the initial value of the score ($p < 0.01$).

Occlusal treatment

The reduction in the clinical dysfunction score was positively correlated to the initial score ($p < 0.01$) but no statistically significant influence on the treatment effect was found for any of the other confounding factors.

Comparison between treatments

The reduction in the clinical dysfunction score after treatment was signifi-

cantly greater after the intra-articular injections than after the occlusal treatment ($p < 0.01$). The confounding variables (Table 2) which *reduce* this difference in treatment effect between the groups are age (Fig. 3), radiographic signs of deviation in shape of the TMJ and general joint symptoms. The confounding variables which *increase* the difference are the subjective dysfunction score at visit I and the number of occluding pairs of teeth (Fig. 4). The difference in treatment effect was also tested in 12 patients (6 from each group) who had similar initial clinical dysfunction score (12–13 units). The difference in treatment effect was statistically significant at the same level when these confounding variables were allowed for one at a time in the tests.

DISCUSSION

There was a significant *subjective improvement* of the condition in both groups. The placebo effect may have played a considerable role in this improvement since pain is a major item in the subjective dysfunction index, and pain is known to be susceptible to placebo effects (13, 14, 15). The patients receiving intra-articular injections, however, did not respond to placebo during the previous conservative treatment.

A marked *clinical improvement* could still be found 2 years after the intra-articular injections. No consistent improvement was, however, observed 2 years after the occlusal treatment, as judged by the clinical dysfunction score. When the effect on single clinical signs was considered, a marked improvement was found for all signs except TMJ sounds after the intra-articular injections, while a statistically signifi-

Table 2. Correlation between confounding factors and reduction of the clinical dysfunction score. (r = product-moment correlation coefficient, \bar{x} = arithmetic mean)

Factors	Corticosteroid group		Occlusal group	
	r	\bar{x}	r	\bar{x}
Age	-0.42	38.0	0.37	45.7
Subjective dysfunction score at visit I	-0.13	4.1	-0.42	3.7
Clinical dysfunction score at visit I	0.66	14.5	0.69	8.3
Duration of TMJ symptoms	-0.29	2.3	-0.31	3.9
Number of occluding pairs of teeth	0.49	10.0	-0.06	8.1
Radiographic changes of TMJ	-0.49	67 %	-0.38	72 %
Deviation in shape	-0.68	33 %	-0.44	39 %
Erosions	0.18	33 %	0.19	22 %
General joint symptoms	-0.61	53 %	-0.43	56 %
Rheumatoid arthritis	-0.31	27 %		

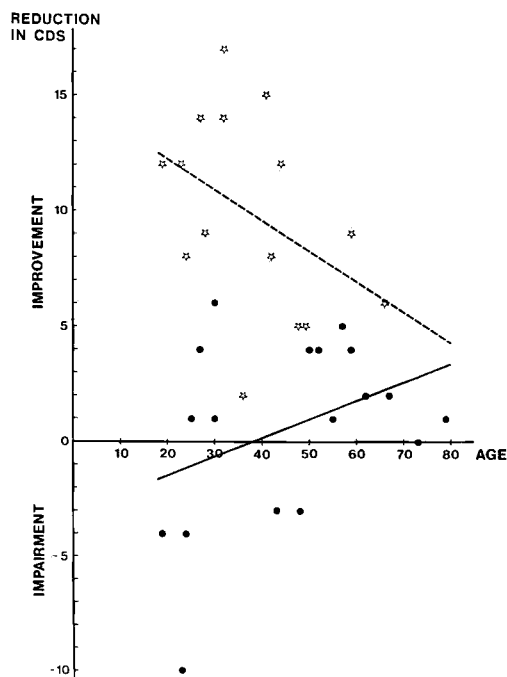


Fig. 3. The relationship between reduction in clinical dysfunction score (CDS) and age. Intra-articular injections (---*): $r = -0.42$; and occlusal treatment (—●): $r = 0.37$.

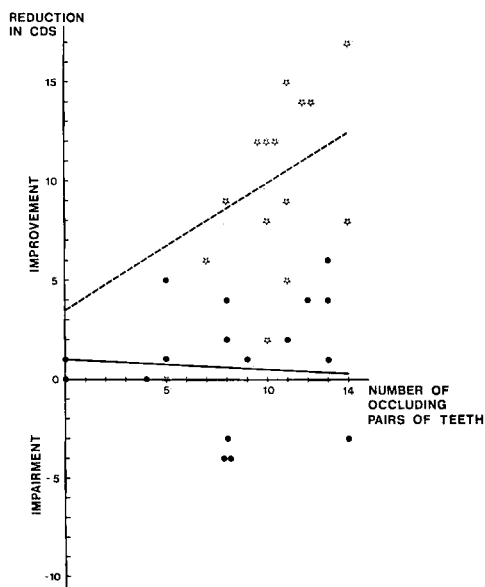


Fig. 4. The relationship between reduction in clinical dysfunction score (CDS) and number of occluding pairs of teeth. Intra-articular injections (---*): $r = 0.49$; and occlusal treatment (—●): $r = -0.06$.

ficant but smaller improvement was found for the same signs in the occlusal group except for tenderness to palpation of the masticatory muscles.

Carlsson, Ekberg & Öberg (2) investigated the effect of 2–3 intra-articular injections of 0.5 ml (2.5 mg) of fluoxiprednisolone acetonide (Kenacort-T®) in 26 patients resistant to conservative treatment. A positive effect, lasting between 1 week and 6 months, was achieved in 75 % of the patients. The material consisted of patients with rheumatoid arthritis, osteoarthritis and unspecific monoarthritis. Toller (17) investigated the effect of single injections of 1.0 ml (40 mg) of prednisolone trimehylacetate in 150 patients with painful TMJ dysfunction refractory to all conservative treatment. The analgesic effect lasted 2–3 months and the overall success rate was 69 %. The result was best in patients above 40 years of age (81 %), a finding which does not agree with the results of this study. No information about the state of the dentition is given, however. The subjective success rates in both cited studies were similar to that in this study. The clinically assessed success rate (only mandibular mobility) was lower in the former study (2) and is not stated in Toller's report (17).

The degree of improvement in this study was influenced by several of the confounding factors recorded. The higher the clinical dysfunction score, the greater was the improvement with both treatments. The patients with radiographic signs of deviation in shape (remodelling) showed less improvement after the intra-articular injections. Deviation in shape of the TMJ is often found radiographically in osteoarthritis of the TMJ (11). The patients who reported general joint symptoms, including those who had diagnosed rheumatoid arthritis, also had a poorer long-term prognosis after the

intra-articular injections. This finding may be explained by the systemic character of this disease, which is only transiently affected by intra-articular injections.

There are differences between the two groups which must be considered when the treatment effects are compared. First, there is a time lag of 3 years between the selection of the two groups. The effect of this difference is limited, however, due to the fact that one of the investigators participated in both studies, and that the patients in both groups were selected according to the same main criterion (tenderness to palpation of the TMJ). A second difference is that the intra-articular injections were given to patients refractory to conservative treatment, which probably means that they were more difficult to cure and also poor placebo reactors. This view is also supported by both the subjective and clinical dysfunction score before treatment, which was much higher in the patients treated with intra-articular injections. The patients in the occlusal group, on the other hand, did not receive any treatment except information and advice before the occlusal treatment. A third difference is that 4 patients with rheumatoid arthritis were included in the group given intra-articular injections, while all such patients were excluded from the occlusal group. Rheumatoid arthritis had a negative influence on the therapeutic effect of the corticosteroid injections, however, and accordingly could not reduce the difference in effect between the two treatments. The difference in age distribution is allowed for in the statistical analysis.

The reduction in clinical dysfunction score was greater after intra-articular injections than after occlusal treatment in this study, even when the effect of the confounding variables had been allowed for. The confounding variables

may reduce or increase the difference in score between the two treatments, depending on the sign and strength of their correlation to the treatment effects. The good long-term *analgesic effect* of the intraarticular injections was unexpected. Corticosteroid have been found to remain in the synovial tissues, and supposedly exert its *anti-inflammatory action* for about 2 weeks only (22). In knee joints affected by rheumatoid synovitis the analgesic effect of injections of betamethasone has been reported to last for a period of between 2 days and 3 months (8). Polyarthritis might, however, differ from monoarthritis with respect to the long-term effect. The primary cause of the TMJ pain/tenderness in the patients was unknown, except for the rheumatoid arthritis patients, but was probably transient in nature in those patients in whom the symptoms did not recur or increase again during the 2-years follow-up. Age and number of occluding pairs of teeth are interesting confounding factors in this context. It seemed that the intra-articular injections had the best effect in young individuals with a full set of natural teeth. Loss of teeth on the other hand may act as a chronic cause of TMJ pain/tenderness, leading to relapse of symptoms when the pharmacodynamic effect of the corticosteroid and the local anaesthetic has ceased. The therapeutic effect of the occlusal treatment, on the other hand, seemed to be less influenced by the number of occluding teeth. It should be stressed that in 16 out of 18 patients the occlusal treatment included a splint which compensated for tooth loss.

The role played by the local anaesthetic has been discussed previously (18) and there is reason to assume that the main effect of the injections was due to the corticosteroid (2).

Inter-observer variability is an im-

portant source of error when clinical variables of this kind are used (3). Each patient was therefore examined by the same observer at both visits and the intra-individual differences in score between visits were tested.

It may be concluded from the results of this study that both intra-articular injections of corticosteroid combined with local anaesthetic and occlusal treatment have a long-term palliative effect on subjective symptoms and clinical signs of mandibular dysfunction in the subgroup of patients with tenderness to palpation of the TMJ. The clinical signs, however, both single and combined, show a significantly greater long-term response to the intra-articular injections. It may also be concluded that the prognosis for the intra-articular injections is most favourable in patients without radiographic signs of TMJ remodelling or general joint symptoms.

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