Treatment Results after Intra-articular Injection of Corticosteroids in Patients with TMJ Arthritis

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ABSTRACT

Arthritis is a common disease affecting the temporomandibular joint. The inflammation causes local pain and decreased function of the masticatory system. Temporomandibular joint arthritis can result from mechanical overloading, general autoimmune disease or individual susceptibility. The aim of this study was to investigate objective and subjective treatment results after intra-articular injection of corticosteroids in patients with temporomandibular joint arthritis. The hypothesis was that treatment with intra-articular injection of corticosteroids relieves clinical signs and subjective symptoms and no difference between objective and subjective treatment outcome was anticipated.

An outcome assessment study with consecutive sample was performed. Objective and subjective data was registered from 70 subjects treated with intra-articular injection of corticosteroids. Statistics were analyzed in SPSS. Subgroup analysis was performed to evaluate and distinguish confounding variables such as sex, age, autoimmune disease (general), previous physical trauma and hard tissue changes.

Maximum mouth opening capacity was increased by 8.7% after treatment demonstrating an objective improvement. Subjects with an initial impaired maximum mouth opening capacity <40 mm showed a greater increase compared to those within the normal range. Subjective assessment at follow-up presented a self-reported improvement in 77% of the subjects. The routines regarding follow-up were found to be inconsistent and subjective assessments scales were missing in about 50% of the cases.

Objective and subjective improvement was observed after intra-articular injection of corticosteroids. This confirms the present treatment recommendations that intra-articular injection is an effective method in relieving signs and symptoms of temporomandibular joint arthritis.

INTRODUCTION

The temporomandibular joint (TMJ) is part of the masticatory system, which is very complex and supports several vital functions such as speaking, chewing, swallowing, tasting and breathing. The hard tissue components of the TMJ are the mandibular condyle and the glenoid fossa and articular eminence of the temporal bone. When the mouth is closed the condyle is situated below and within the glenoid fossa of the temporal bone. At mouth opening the condyle rotates and translates to a position under the articular eminence. These bony structures are mainly covered by dense fibrous connective tissue and cartilage. Further, the condyle and the temporal part are separated by an articular disc. The disc divides the articular space into a superior and an inferior cavity. The disc is avascular and consists of fibrous connective tissue, whereas its attachments are vascularized and innervated. Capsular ligaments surround the joint and passively restrict extreme movements. These ligaments also attach the articular disc anteriorly, posteriorly, medially and laterally. Intra-articular structures that are not cartilaginous are covered by a synovial membrane that produces synovial fluid. This fluid fills both joint cavities and works as a lubricant during functions of the TMJ. It also provides the articular tissues with nutrients (Okeson 2013).

The masticatory system can sometimes become afflicted by problems involving the TMJ, the masticatory muscles, structures nearby or a combination of these. When such problems occur they are defined as temporomandibular disorders (TMD) (Dym and Israel 2012; Okeson 2013).

A disease commonly affecting the TMJ is arthritis, and most frequently as osteoarthritis (OA) (Møystad et al. 2008; Okeson 2013). OA is characterized by progressive damage and reduction of articular cartilage and a decrease in synovial fluid. These changes can result in clinical symptoms such as pain, noises from the joint (crepitus) and impaired function. Radiographic findings of OA are e.g. osteophytes, hypertrophic changes and cortical degeneration (de Souza et al. 2012).

The TMJ is a structure normally committed to heavy loading, yet there must be a balance between healthy loading and overloading. In case of mechanical overloading, due to e.g. parafunction, malocclusion, micro- or macro trauma, the TMJ can respond with biochemical changes that lead to synovial tissue inflammation and TMJ arthritis (Cairns 2010; Dym and Israel 2012; Okeson 2013). These changes can in turn lead to cartilage degradation, immobilization of the joint and adhesions of the disc. Other etiologic factors that cause or

contribute to development of TMJ arthritis are systemic inflammatory disease and consequences of general degenerative joint disease (Kopp et al. 1985). According to previous research, various factors such as sex, age, general health status, nutrition and genetics can affect the susceptibility towards degenerative disease in the TMJ (Milam 2005).

There are several treatment options for management of TMJ arthritis. If the patient does not respond to conservative treatment, including counseling, mandibular exercises, occlusal splints and/or occlusal grinding, intra-articular injection of drugs can be effective (Kopp and Wennerberg 1981). Symptoms as pain from inflammation in TMJ arthritis can be suppressed by local administration of corticosteroids. Long-term prognosis is differing between patients and the effect is also thought to vary between different pain entities due to underlying molecular mechanisms of pain (Fredriksson et al. 2005).

Local administration of hydrocortisone to arthritic joints has been performed since the early 1950-ies. Treatment has been reported helpful in cases of arthritis measured in reduction of signs and symptoms (Hollander et al. 1951; Kopp and Wenneberg 1978).

Correct technique for injection is important to avoid side effects; if the drug is injected subcutaneous this can cause soft tissue atrophy (Jones et al. 1993; Kumar and Newman 1999). If the corticosteroid is mixed with a contrast medium and injected into the TMJ under fluoroscopic control after local anesthesia, the administration into the joint is facilitated. The corticosteroid is administrated into the lower and upper joint compartments where the site of inflammation is the synovial membrane. Fluoroscopic technique allows recording of the administration and TMJ movements for documentation (Ahlqvist and Legrell 1993). Studies have shown a significant improvement within 24 h after treatment regarding swelling, tenderness and reduced freedom of motion (Hollander et al. 1951). Other studies have shown that intra-articular injections significantly increase maximum mouth opening capacity, decreases number of muscles tender to palpation, tenderness to palpation of the TMJ and pain during mandibular movement. TMJ resting pain has also been shown to decrease after treatment (Fredriksson et al. 2006). No change, however, was detected regarding TMJ sounds as clicking or crepitation in a study by Kopp and Wenneberg 1981.

The aim of this study was to investigate objective and subjective treatment results after intra-articular injection of corticosteroids in patients with TMJ arthritis. Subgroups of patients based on sex, age and diagnosis were studied in search for possible differences in treatment outcome. The hypothesis was that treatment with intra-articular injection of corticosteroids

relieves clinical signs and subjective symptoms and no difference between objective and subjective treatment outcome was anticipated.

MATERIAL AND METHODS

Material

The PubMed database was searched without language restrictions. Terms used for finding articles were: temporomandibular joint, TMJ, arthritis, corticosteroids, treatment, intra-articular injection, injection. The National Board of Health and Welfare references regarding intra-articular corticosteroids treatment of TMJ arthritis associated with inflammatory disease was also considered. Their recommendations are based on previous research and reports from an expert audience. The choice of treatment in the clinical situation is based on these recommendations.

All patients (70 subjects) treated with intra-articular injection of corticosteroids in the TMJ at the Department of Oral and Maxillofacial Radiology, Public Dental Health Service of County Council of Västerbotten, from January 2011 to November 2013 were included in the study. Data was collected from patient charts in T4. In cases where patients had undergone multiple treatments, data from the first treatment occasion and from the first follow-up were collected. All patient information was decoded thus patients could not be identified.

The decoding key was stored in a safe and destroyed when data collection and analyses were completed.

Methods

The study design used was an outcome assessment with a consecutive sample. The protocol for data collection was designed to obtain all information necessary to test the hypothesis (Appendix 1).

All patients had their clinical examinations (baseline and follow-up) at the Department of Clinical Oral Physiology, Public Dental Health Service of County Council of Västerbotten.

Objective treatment results were deduced from recorded data regarding maximum mouth opening. This clinical parameter is attained by measuring the inter-incisal distance and taking the overbite into consideration. Maximum mouth opening < 40 mm was regarded as impaired mouth opening (Helkimo 1974). Possible changes were registered by comparing data from baseline with corresponding data from follow-up.

Subjective treatment results were deduced from four different rating scales that were filled out by the patients at baseline and follow-up.

NRS, numeric rating scale, ranges intensity from 0-10. Where 0 represents "no pain" and 10 represents "worst possible pain".

Frequency describes the occurrence of discomfort ranging from 0-5. Where 0 represents "never", 1 "sporadic", 2 "a few times a month", 3 "a few times a week", 4 "several times a week" and 5 "daily".

BI, besvärsgradsindex, results from multiplying NRS (0-10) by frequency (0-5). Values consequently can range from 0 to 50.

GRS, global rating scale, the subjects rate aspects of their experience after treatment. The scale ranges from -3 to +3; -3 represents "very much worsened", -2 "much worsened", -1 "somewhat worsened", 0 "unchanged", +1 "somewhat improved", +2 "much improved", and +3 "very much improved".

Each rating scale addresses five different problem areas where the subjects themselves report and rate their perceived comfort or discomfort. Outcome was studied by comparing the initial questionnaires with the questionnaires from the follow-up. The areas studied were; "pain/ache from the face/jaws", "headache", "TMJ fatigue", "TMJ-sounds" and "TMJ-locking". From these areas, self evaluated "pain/ache from face/jaws" was chosen for statistical analyses since this area corresponds best with the symptoms of TMJ arthritis.

Subgroup analysis

There were 58 women (83%) and 12 men (17%) included in this study.

Patients were divided into four age groups with comparable interval and number of subjects; 11 patients < 20 years (16%); 22 patients 20-39 years (31%); 23 patients 40-59 years (33%) and 14 patients > 60 years (20%).

Diagnoses were divided into autoimmune disease, previous physical trauma to head-neck-jaw region and hard tissue changes. Distribution among these subgroups is presented under results.

Statistical methods

IBM SPSS (Version 22) was used for statistical analyses. Paired t-test was used for comparing maximum mouth opening capacity before and after treatment. Subgroup analyses were performed to evaluate and distinguish confounding variables. Mann-Whitney U test was used when testing variables that were not on interval scales and when normal distribution could not be assumed. Tests were considered significant when probability levels were <0.05.

Ethical reflection

During the process of data collection, information was extracted from charts of patients suffering from TMJ arthritis treated with intra-articular injection of corticosteroids. This was done without knowledge and approval from the patients which call for an ethical discussion. The Patient Data Act SFS 2008:355 4§ support this procedure since it concerns quality assurance, follow-up and evaluation of treatment and care. The estimated overall benefit was judged to be greater than the possible disadvantage for the individual patient. Possible disadvantage is subjective in terms of personal integrity when collecting data from the charts without notifying the subjects. Benefits include possibilities to improve treatment outcomes in the future by identifying factors that can optimize the use of corticosteroid injection in the TMJ. Today, knowledge about how different patient related factors influence the outcome of this treatment is incomplete. The Ethics committee at the Department of Odontology, Umeå University approved the study to be performed and that the study fulfills the demands for ethical considerations as a student project.

RESULTS

Objective treatment outcome (maximum mouth opening capacity)

There was a statistically significant increase in maximum mouth opening capacity after injection (P=0.000). The mean value of improvement was 3.8 mm (± 7.5) in maximum mouth opening capacity, and the relative increase was 8.7% (median). Mean value at baseline was 36.9 mm (±11.1) and at follow-up 40.7 mm (±8.3). Data was missing in 20% of the subjects. Subjects with an initial impaired maximum mouth opening capacity (<40 mm) had a statistically significant improvement in mouth opening (P=0.000). The mean improvement was 6.2 mm (±7.7) and the relative increase was 15.6 % (median) after treatment. Initial maximum mouth opening capacity >40 mm showed a decrease in maximal mouth opening capacity, the mean value was -0.2 mm (±5.4).

Results are displayed in Figure 1.

Subjective treatment outcome ("pain/ache from the face/jaws")

Numeric Rating Scale: 80.6% of the subjects reported improvement; 13.9 % worsening and 5.6% unchanged. Data values were missing in 48.6% of the subjects.

Frequency: 42.9% of the subjects reported improvement; 5.7 % worsening and 51.4% unchanged. Data values were missing in 50% of the subjects.

BI: 82.9% of the subjects reported improvement; 11.4% worsening and 5.7% unchanged. Data values were missing in 50% of the subjects.

Global Rating Scale: 77.4% of the subjects reported varying degrees of improvement (Figure 2d); 6.5% somewhat worsened and 16.1% unchanged. Data values were missing in 55.7% of the subjects.

The follow-up data of subjective assessment are given in Figure 2.

The median value of maximum mouth opening difference increases in accordance with the degree of self-reported improvement, indicating that there is a positive correlation between these two parameters (Figure 3).

Subgroup analysis

Subjective data was missing in approximately 50% of the cases and therefore subgroup analysis was not performed for subjective treatment results.

Sex and age

In this study 17% of the subjects were men and 83% women. A Mann-Whitney U Test showed that there is a significant difference between sexes in treatment outcome in measures of maximum opening, where women showed a greater improvement (P=0.043). Treatment outcome in terms of Global Rating Scale displayed a variance between sexes, where women in average experienced "much improvement" whereas men in average experienced "somewhat improvement". Results were distracted from a boxplot with median values.

A Mann-Whitney U Test displayed no significant difference between different age groups regarding treatment outcome measured as maximum mouth opening capacity (P>0.05). Further, there was no correlation between initial impaired maximum opening and objective treatment outcome among the age groups.

Autoimmune Diseases (General)

Number of subjects diagnosed with autoimmune disease was 14 of 70 (20%). After drop-out a Mann-Whitney U Test was conducted on 7 patients with autoimmune disease and 49 without, and no significant difference in maximum mouth opening capacity was seen between the two groups (P>0.05).

Physical trauma

Number of subjects with reported physical trauma was 28 of 70 (40%). After drop-out a Mann-Whitney U Test was calculated for 26 subjects with physical trauma to head-neck-jaw region and 30 without. A significant difference in maximum mouth opening capacity was shown between the two groups after injection (P=0.011). Also, an independent t-test was executed where subjects with previous trauma had a mean improvement after injection of 2.25mm (±9.78) in maximum opening, and the group without physical trauma had a mean improvement of 5.10mm (±4.63). This proved to be a significant difference in treatment outcome between the groups (P=0.034).

Hard tissue changes

Four subjects had missing values (6%). Hard tissue changes was seen in 57 of 66 (86%), and 9 patients had no hard tissue changes identified (14%). Hard tissue changes, such as remodeling, osteoarthritis and osteoarthrosis, were identified through radiological examination. After drop-out a Mann-Whitney U Test was used on 45 subjects with hard tissue changes and 8 without. A significant difference in maximum mouth opening capacity was seen between these two groups after injection, where subjects with identified hard tissue changes demonstrated a better objective treatment outcome (P=0.000).

Time between corticosteroid injection and follow-up was not consistent, ranging from 22 to 544 days. In six cases follow-up was never performed.

DISCUSSION

This study reveals that intra-articular corticosteroid injections have a positive effect on maximum mouth opening capacity. Maximum mouth opening capacity is considered as the most reliable clinical parameter when measuring treatment outcome, and has therefore been used to a great extent in this study. Previous research also reveals that other clinical parameters show low constancy (Kopp 1977). The mean value at baseline indicates that patients in average had impaired maximum mouth opening capacity, which was normalized after treatment. Subjects with an initial impaired maximum mouth opening capacity (<40 mm) had a greater increase compared to those with a maximum mouth opening capacity within normal ranges 40-60 mm. Patients with initial values of maximum mouth opening capacity within normal range is less likely to increase their capacity. This finding is in accordance with previous research, stating that if the maximum mouth opening capacity at baseline is unaffected or comparable to healthy values it cannot be expected to see a significant increase in maximum mouth opening capacity (Stoustrup et al. 2013). To evaluate the treatment outcome for subjects with initial values of maximum mouth opening ≥40 mm other clinical parameters may be more adequate. During data collection TMJ pain on palpation and TMJ pain on joint loading was also recorded. It has been suggested that corticosteroids may influence different on clinical parameters such as TMJ pain on palpation, TMJ pain on joint loading and resting pain (Fredriksson et al. 2005). However, these parameters had high counts of missing values and were therefore not tested statistically.

Another factor to consider is the smallest detectable difference in maximal mouth opening capacity. It has previously been shown that measurements can differ up to five millimeters, suggesting that improvement is only reliable when larger than 5 mm (Stoustrup et al. 2013). Results in this study must be interpreted with care, however subjects with an initial impaired mouth opening capacity had an increased mean value of 6.2 mm and the conclusion that the treatment in this group had an effect on mouth opening capacity is therefore considered reliable.

Previous studies have shown that there is an interobserver variability among dentists for examination procedures such as palpation and measurement of mandibular movement (Kopp 1977). Most patients in this project (89%) were examined by the same dentist at baseline and follow-up. By using a clinical parameter with high constancy and having most patients examined by the same dentist the findings are regarded as reliable.

Data from the subjective assessment scales were missing in 49-56% of the cases. This indicates that there is a potential for improvement regarding the routine for collecting subjective treatment evaluation at the Department of Clinical Oral Physiology at Public Dental Service of County Council of Västerbotten. Particularly the follow-ups were not performed consistently and were sometimes completely missing. However, the drop-out was considered random and data was therefore used for statistical analysis and conclusions. The majority of patients (77%) reported improvement of "pain/ache from face/jaws" after receiving treatment. Pain intensity (NRS) showed larger reduction compared to pain frequency at follow-up. These findings suggest that intra-articular injection is effective in reducing symptoms. Statistical tests comparing subjective and objective improvement in subgroups were not performed since the groups were too small. A boxplot indicates, however, that there is an association between the median value of maximum opening difference and the degree of self-reported improvement (Figure 3). Still, it is considered that there are some weaknesses to subjective assessment scales. This may be due to poor memories of pre-treatment condition which can cause an over-/underestimation during the treatment evaluation. The estimation can also be affected by the mood. There is limited previous research studying the test-retest reliability of subjective assessments scales according to Kamper et al. 2009. Another factor to take into consideration is the placebo effect since it is known to influence pain (Lasagna et al. 1954). Since all subjects in this study had received different kinds of treatment previous to injection of corticosteroids, the placebo effect is, however, less likely to be a part of the subjective reported improvement.

The number of women treated in this study was almost five times larger than the number of men. This ratio is similar to previous studies stating that TMD signs and symptoms are more prevalent in women than in men. Prevalence between women and men has been reported to range from 2:1 to 6:1 (Carlsson 1999, Dym and Israel 2012, Ernberg 2004). It has not been concluded what causes this difference, yet it has been proposed that the fact that women constitute a majority among the care seekers may be due to psychological and hormonal differences (Johansson et al. 2003). The findings in our study show a significant sex difference where women had a larger improvement in maximum mouth opening capacity. Women also rated their improvement higher than men. However, the number of men is too small in order to conclude if this is valid for the population. Age did not influence treatment outcome.

Previous physical trauma to the head-neck-jaw area has a negative correlation on treatment outcome in terms of maximum mouth opening difference. This could possibly be explained by permanent damage to the TMJ, which is not only caused by inflammation, and therefore corticosteroids are less effective. The exact location of impact and dynamics of the reported trauma was, however, not possible to deduce and this explanation must therefore be read with care.

Identified hard tissue changes indicate a more extensive progression of disease in the TMJ. Individuals with such signs have more potential regarding improvement in treatment outcome than subjects without structural changes in the TMJ. This may explain the difference in improvement when comparing the two groups.

Patients with autoimmune disease (general) did not show a significant difference in maximum mouth opening after injection, compared to those without such diagnosis. Previous studies report a poorer long term prognosis for subjects with general joint symptoms compared to patients without (Kopp and Wenneberg 1981). However, their long term prognosis was evaluated after 24 months, whereas this project estimated treatment outcome after less than 3 months (median value).

Another factor that may influence the development of TMJ arthritis is malocclusion, where subjects with a large number of occluding pairs of teeth seem to have a better effect of intra-articular corticosteroid treatment than those with less number of teeth (Kopp and Wenneberg 1981). Number of occluding pairs of teeth is a confounding variable that was not taken into

consideration in this retrospective study since there was no data registered regarding this factor.

Five subjects (7%) underwent a discectomy after the intra-articular corticosteroid treatment. This can imply that they did not experience an adequate relief of symptoms or may have had severe structural damage. Previous studies demonstrate that some patients are resistant to reversible treatment, including injection of corticosteroids, and therefor require surgical treatment (Guarda-Nardini et al. 2008).

Today, The National Board of Health and Welfare recommend intra-articular injection of corticosteroids as the number one treatment of TMJ arthritis. Their evaluation based on previous research demonstrates a moderate effect on pain relief and pain on palpation, moderate to high effect on global improvement and low effect on maximum mouth opening capacity. Corticosteroids are often administrated to relieve pain, however, the results in this study indicates that such treatment also is effective in improving maximum mouth opening capacity.

In conclusion, the results of this study support the hypothesis that intra-articular injection of corticosteroids is a good treatment in terms of relieving clinical signs and subjective symptoms in patients with TMJ arthritis. The increase in maximum mouth opening was significant for subjects with an initial impaired maximum mouth opening. Also, correlation between maximum mouth opening capacity and self-reported improvement was indicated which suggests that there is an agreement between objective and subjective treatment outcome.

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REFERENCES

Ahlqvist J, Legrell PE (1993). A technique for the accurate administration of corticosteroids in the temporomandibular joint. *Dentomaxillofac Radiol* 22: 211 -213.

Cairns BE (2010). Pathophysiology of TMD pain – basic mechanisms and their implications for pharmacotherapy. *J Oral Rehabil* 37: 391-410.

Carlsson GE (1999). Epidemiology and treatment need for temporomandibular disorders. *J Orofac Pain* 13: 232-237.

Dym H, Israel H (2012). Diagnosis and treatment of temporomandibular disorders. *Dent. Clin. North Am.* 56: 149-161.

Ernberg M (2004). Könsskillnader vid kranofacial smärta. *Tandlakartidningen*. 14: 66-70.

Freitas de Souza R, Lovato da Silva CH, Nasser M, Fedorowicz Z, Al-Muharraqi, MA (2012) Interventions for the management of temporomandibular joint osteoarthritis. Cochrane Database Syst Rev 18: 1-36.

Fredriksson L, Alstergren P, Kopp S (2005). Serotonergic mechanisms influence the responset o glucocorticoid treatment in TMJ arthritis. *Mediators Inflamm.* 4: 194-201.

Fredriksson L, Alstergren P, Kopp S (2006). Tumor necrosis factor-alpha in temporomandibular joint synovial fluid predicts treatment effects on pain by intra-articular glucocorticoid treatment. *Mediators Inflamm.* 6: 1-7.

Guarda-Nardini L, Manfredini D, Ferronato G (2008). Total temporomandibular joint replacement: a clinical case with a proposal for post-surgical rehabilitation. *J Craniomaxillofac Surg* 36: 403-409.

Helkimo M (1974). Studies on function and dysfunction of the masticatory system II Index for anamnestic and clinical dysfunction and occlusal state. *Swed Dent J* 67: 101-119.

Hollander JB, Brown EM Jr, Jessar RA, Brown CY (1951). Hydrocortisone and cortisone injected into arthritic joints; comparative effects of and use of hydrocortisone as a local antiarthritic agent. *J Am Med Assoc* 147:1629 -1635.

Johansson A, Unell L, Carlsson GE, Söderfeldt B, Halling A (2003). Gender difference in symptoms related to temporomandibular disorders in a population of 50-year-old subjects. *J Orofac Pain* 17: 29-35.

Jones A, Regan M, Ledingham J, Pattrick M, Manhire A, Doherty M (1993). Importance of placement of intra-articular steroid injections. *BMJ* 307: 1329-1330.

Kamper SJ, Maher CG, Mackay G (2009). Global rating of change scales: a review of strenghts and weaknessess and considerations for design. *J Man Manip Ther* 17: 163-170.

Kopp S, Wenneberg B (1981). Effects of occlusal treatment and intraarticular injections on temporomandibular joint pain and dysfunction. *Acta Odontol. Scand.* 39: 87-96.

Kopp S (1977). Constancy of clinical signs in patients with mandibular dysfunction. *Community Dent Oral Epidemiol* 5: 94-98.

Kopp S, Wenneberg B (1978). Short-term effect of intra-articular injections of a corticosteroid on temporomandibular joint pain and dysfunction. *Swed Dent J* 2: 189-196.

Kopp S, Wenneberg B, Haraldson T, Carlsson GE (1985). The short-term effect of intra-articular injections of sodium hyaluronate and corticosteroid on temporomandibular joint pain and dysfunction. *J Oral Maxillofac Surg* 43: 429-435.

Kumar N, Newman RJ (1999). Complications of intra- and peri-articular steroid injections. Br *J Gen Pract* 49: 465-466.

Lasagna L, Mosteller F, von Felsinger JM, Beecher HK (1954). A study of the placebo response. *Am. J. Med.* 16: 770-779.

Milam S.B. (2005) Pathogenesis of degenerative temporomandibular joint arthritides. *Odontology* 93: 7-15.

Møystad A, Mork-Knutsen BB, Bjørnland T (2008). Injection of sodium hyaluronate compared to a corticosteroid in the treatment of patients with temporomandibular joint osteoarthritis: a CT evaluation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 105: e53-e60.

Okeson JP (2013). Management of temporomandibular disorders and occlusion. St. Louis: Mosby, pp. 5, 18, 340.

Stoustrup P, Kristensen KD, Verna C, Küseler A, Pedersen TK, Herlin T (2013). Intra-articular steroid injection for temporomandibular joint arthritis in juvenile idiopathic arthritis: A systematic review on efficacy and safety. Semin. *Arthritis and Rheum.* 43: 63-70.

Table 1. Descriptive statistics

a. Background variables. Distribution by sex, age, general autoimmune disease, previous physical trauma, hard tissue changes and follow-up.
Number of subjects (n), percentage (%).

Background variables	**n**	**%**
Sex		
Female	58	83
Male	12	17
Age (years)		
<20	11	16
20-39	22	31
40-59	23	33
>60	14	20
Autoimmune Disease (General)		
Yes	14	20
No	56	80
Physical trauma to head-neck-jaw		
Yes	28	40
No	42	60
Hard tissue changes		
Yes	57	86
No	9	14
Missing value	4	6
Follow-up		
Yes	64	91
No	6	9
Same dentist as at baseline	57	89

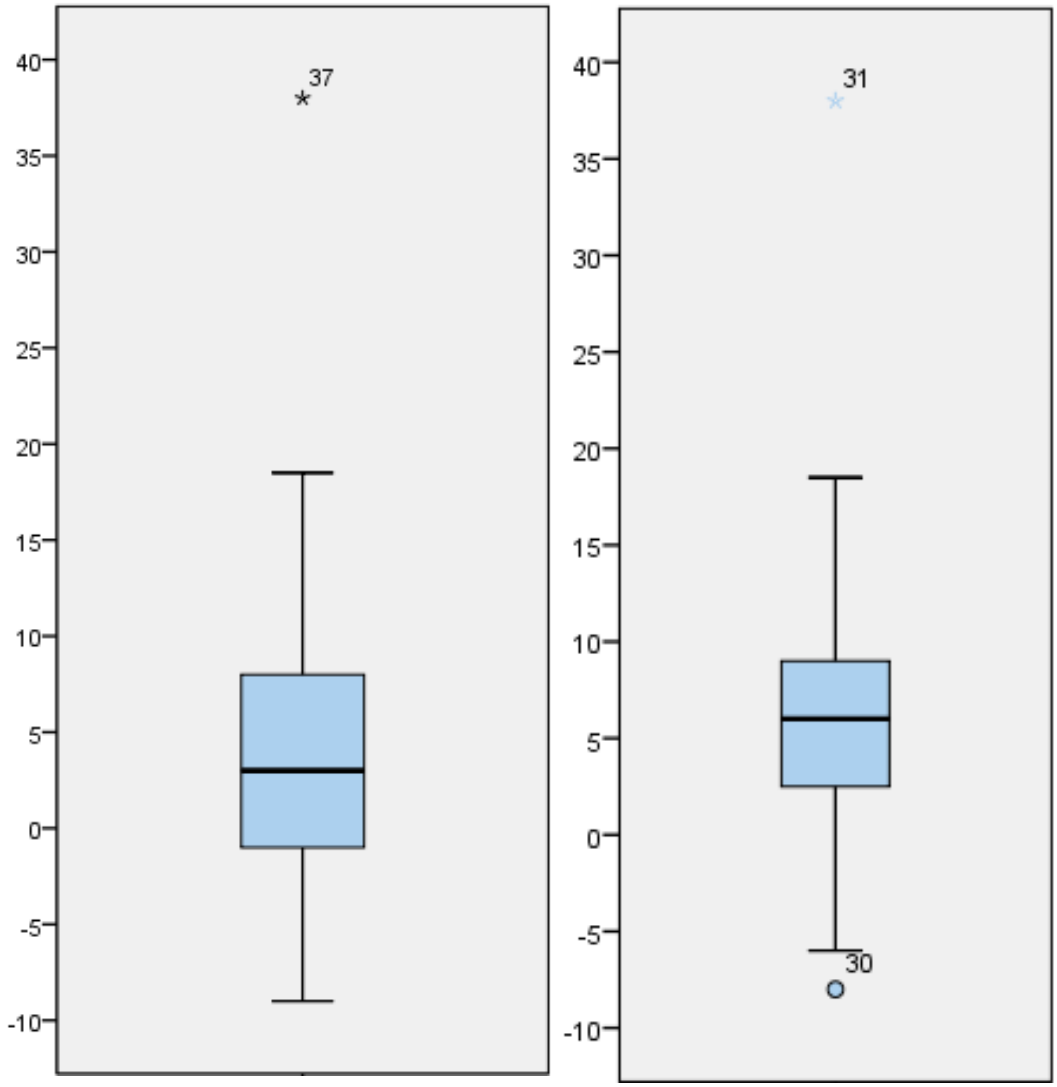
b. Clinical variables in terms of maximum mouth opening capacity at baseline, maximum mouth opening capacity at follow-up, maximum mouth opening difference and days until follow-up. Mean values ± standard deviation (SD).

Clinical variables	**Mean (±SD)**	**Valid/Missing value (n)**
Maximal opening baseline (mm)	36.9 (±11.1)	56/14
Maximal opening after treatment (mm)	40.7 (±8.3)	56/14
Maximal opening difference		
mm	3.8 (±7.5)	56/14
Days until follow-up	81 (median)	64/6

c. Subjective assessment. Numeric Rating Scale, Frequency, Besvärsgradsindex and Global Rating Scale. Number of valid evaluations and missing values.

Subjective assessment	**Valid/Missing value (n)**
Numeric Rating Scale	36/34
Besvärsgradsindex	35/35
Frequency	35/35
Global Rating Scale	31/39

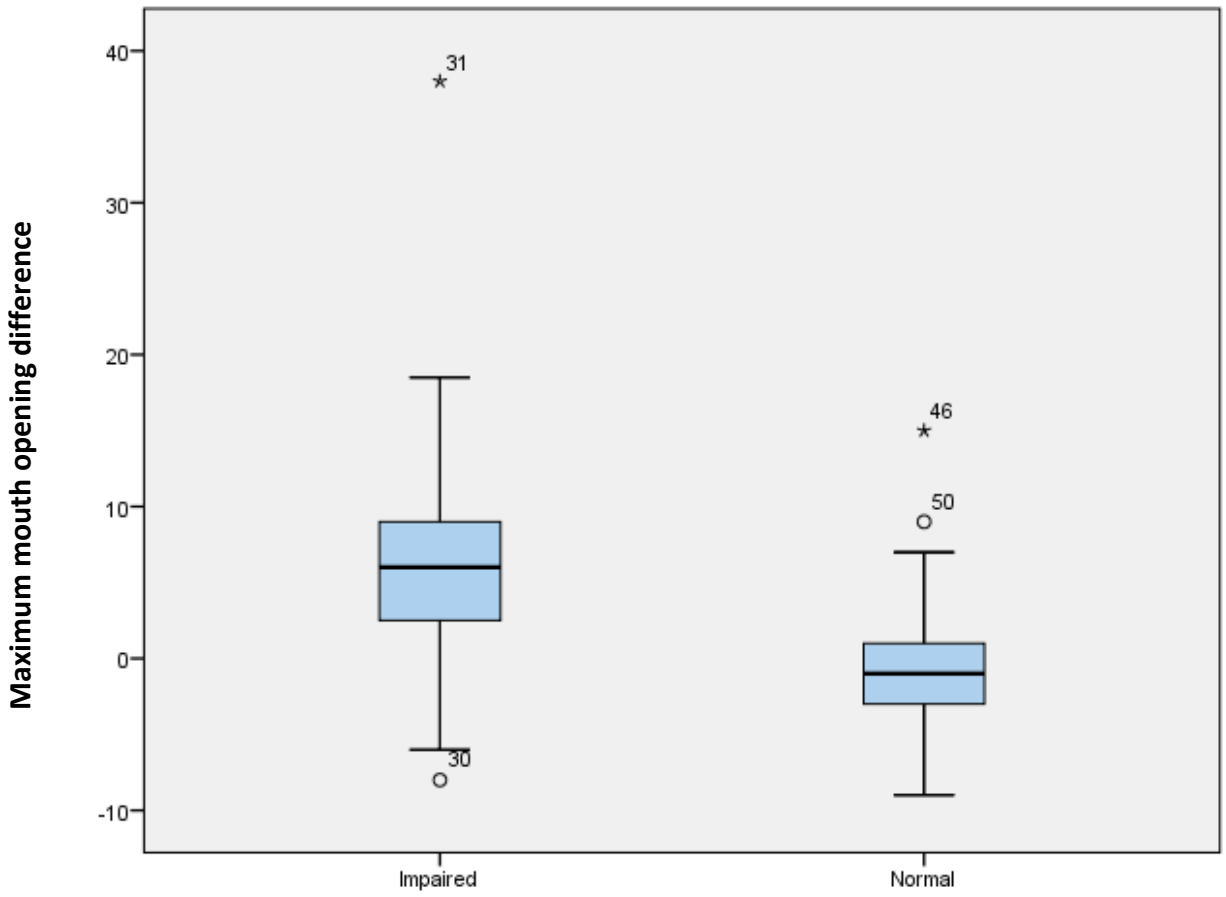
Figure 1. Clinical treatment outcome measured in mm



All particpants **Group with initial impaired mouth opening**

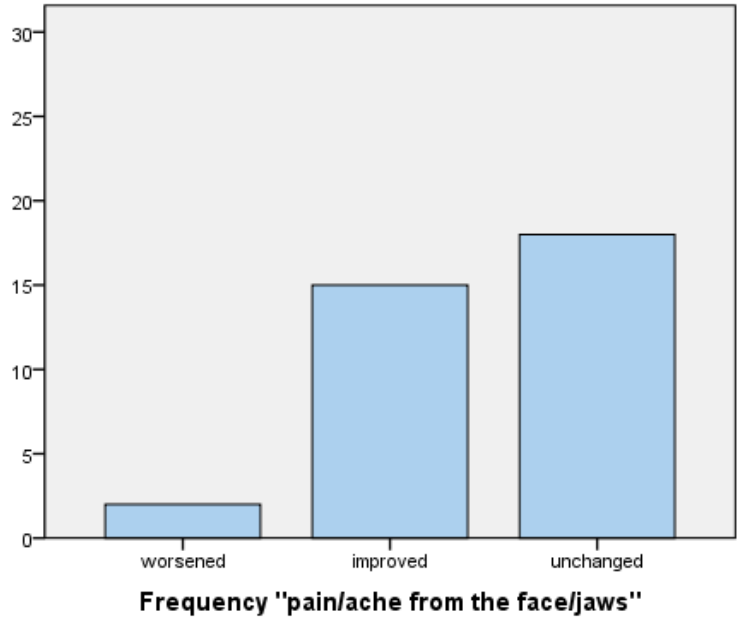
a. *Clinical treatment outcome in terms of maximum mouth opening difference when including normal and impaired baseline values.*

b. *Clinical treatment outcome in terms of maximum mouth opening difference when baseline value was impaired (<40mm).*

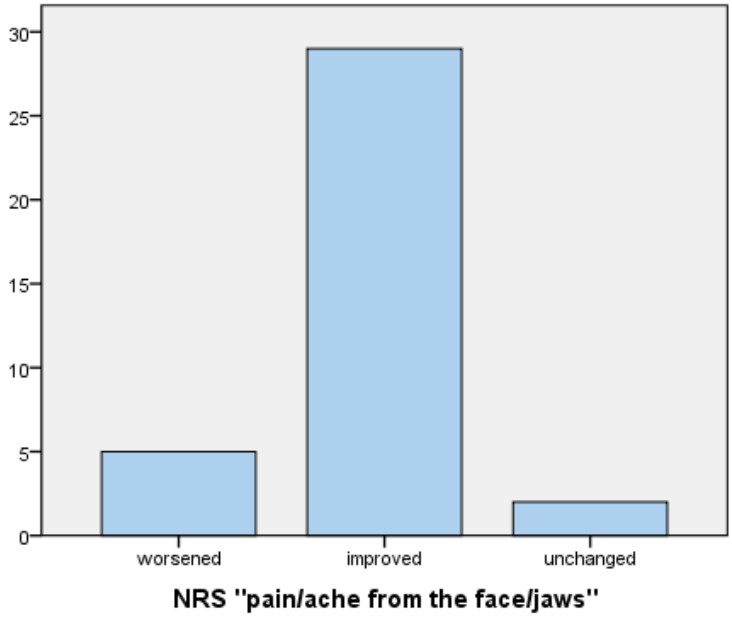


c. Clinical treatment outcome in terms of maximum mouth opening difference when comparing impaired (<40 mm) and normal (≥40 mm) baseline values.

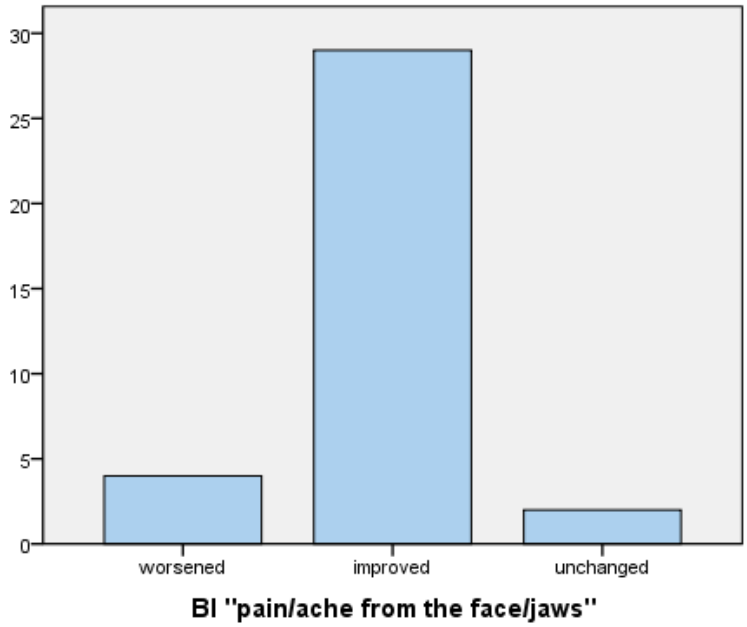
Figure 2. Subjective assessment of the treatment outcome



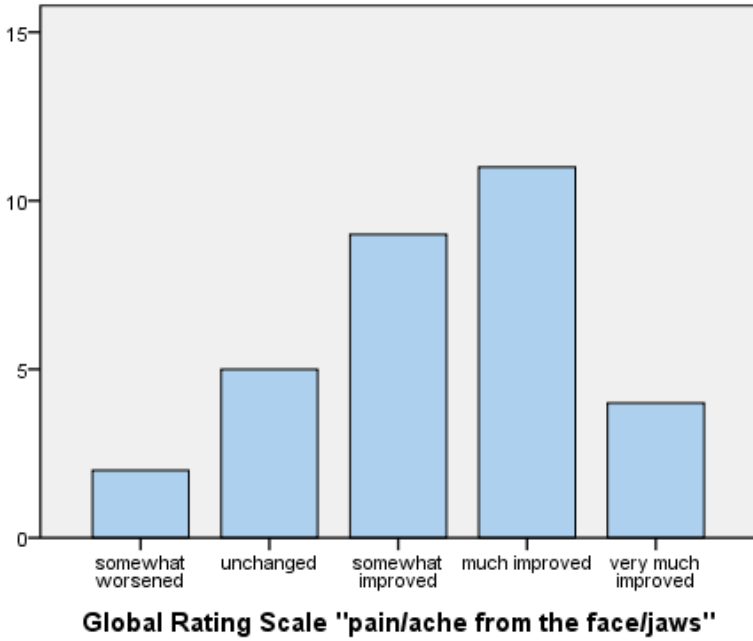
a. Frequency; self-reported assessment in terms of pain frequency after treatment



b. Numeric Rating Scale; self-reported assessment in terms of pain intensity after treatment

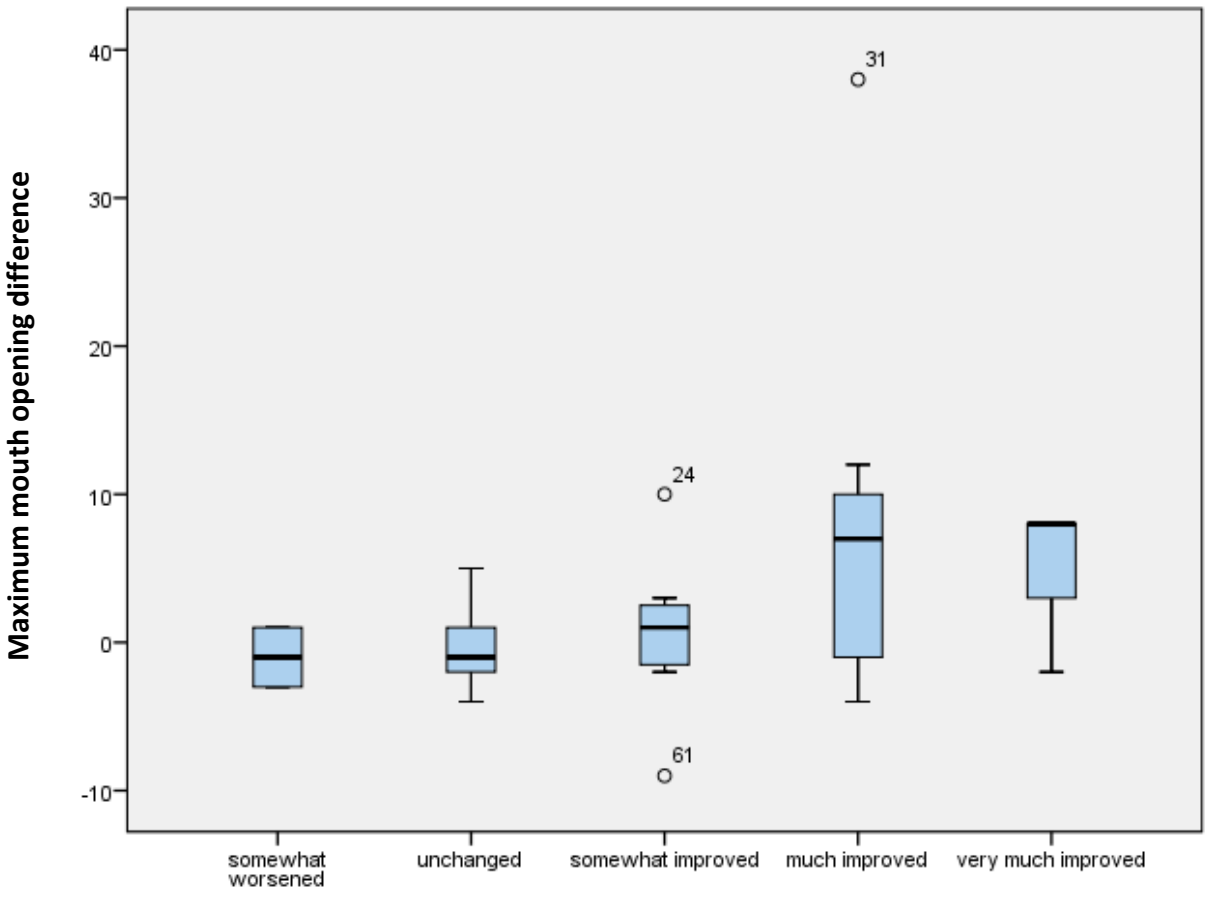


c. Besvärsgradsindex; self-reported assessment in terms of intensity and frequency after treatment



d. Global Rating Scale; self-reported assessment in terms of general aspects after treatment

Figure 3. Subjective assessment of improvement after treatment compared with the clinical outcome in terms of maximum mouth opening difference (mm)



Appendix 1.

Kod

Patientprotokoll

Kön	☐ kvinna	☐ man		
Ålder	☐ <20	☐ 20-39	☐ 40-59	☐ ≥60
Höger käkled injicerad	☐ nej	☐ ja, datum……		
Smärtlindring av symptom vid bedövning **höger**	☐ nej	☐ ja	☐ framgår ej	
Vänster käkled injicerad	☐ nej	☐ ja, datum……		
Smärtlindring av symptom vid bedövning **vänster**	☐ nej	☐ ja	☐ framgår ej	
Uppföljning gjord	☐ nej	☐ ja, datum…….		
Samma tdl vid baseline+uppföljning	☐ nej	☐ ja		

Anamnes

Sjukdomar

Generell autoimmun sjukdom	☐ nej	☐ ja;	☐ framgår ej
Fibromyalgi	☐ nej	☐ ja;	☐ framgår ej
Antidepressiva läkemedel	☐ nej	☐ ja;	☐ framgår ej
Fysiskt trauma	☐ nej	☐ ja;	☐ framgår ej
		Om ja, lokalistation;…….	

Anamnestiska skalor

NRS 0-10	Start	Uppföljning
Värk/smärta i ansikte/käkar	.....	.....
Huvudvärk	.....	.....
Trötthetskänslor i käkarna	.....	.....
Käkledsljud	.....	.....
Käkledsupphakning/-låsning	.....	.....

Frekvens 0-5	Start	Uppföljning
Värk/smärta i ansikte/käkar	.....	.....
Huvudvärk	.....	.....
Trötthetskänslor i käkarna	.....	.....
Käkledsljud	.....	.....
Käkledsupphakning/-låsning	.....	.....

BI 0-50	Start	Uppföljning
Värk/smärta i ansikte/käkar	.....	.....
Huvudvärk	.....	.....
Trötthetskänslor i käkarna	.....	.....
Käkledsljud	.....	.....
Käkledsupphakning/-låsning	.....	.....

Global skattningsskala -3 - +3	(vid uppföljning)
Värk/smärta i ansikte/käkar	.....
Huvudvärk	.....
Trötthetskänslor i käkarna	.....
Käkledsljud	.....
Käkledsupphakning/-låsning	.....

Status

Diagnoser käkleden

Klinisk diagnos

Höger käkled	☐ nej	☐ ja;	☐ framgår ej
		☐ diskförskjutning med återgång	
		☐ diskförskjutning utan återgång	
		☐ artros	
Vänster käkled	☐ nej	☐ ja;	☐ framgår ej
		☐ diskförskjutning med återgång	
		☐ diskförskjutning utan återgång	
		☐ artros	

Radiografisk diagnos

Hårdvävnadsundersökning

Fynd höger käkled	☐ nej	☐ ja;	☐ framgår ej
		☐ artrit	
		☐ artros	
		☐ remodellering	
Fynd vänster käkled	☐ nej	☐ ja;	☐ framgår ej
		☐ artrit	
		☐ artros	
		☐ remodellering	

Mjukvävnadsundersökning (artrografi)

Fynd höger käkled	☐ nej	☐ ja;	☐ framgår ej
		☐ diskförskjutning	
		☐ perforation	
		☐ adherenser	
Fynd vänster käkled	☐ nej	☐ ja;	☐ framgår ej
		☐ diskförskjutning	
		☐ perforation	
		☐ adherenser	

Käkrörelser

	Start	Uppföljning
Maximal gapning (mm)	…….	…….
Laterotrusion **hö** (mm)	…….	…….
Laterotrusion **vä** (mm)	…….	…….
Protrution (mm)	…….	…….

Käkledssmärta

Höger käkled

Palpationssmärta över käkled **före** kortisoninj.	☐ nej	☐ ja	☐ framgår ej
Ledbelastningssmärta **före** kortisoninj.	☐ nej	☐ ja	☐ framgår ej
Palpationssmärta över käkled **efter** kortisoninj.	☐ nej	☐ ja	☐ framgår ej
Ledbelastningssmärta **efter** kortisoninj.	☐ nej	☐ ja	☐ framgår ej

Vänster käkled

Palpationssmärta över käkled **före** kortisoninj.	☐ nej	☐ ja	☐ framgår ej
Ledbelastningssmärta **före** kortisoninj.	☐ nej	☐ ja	☐ framgår ej
Palpationssmärta över käkled **efter** kortisoninj.	☐ nej	☐ ja	☐ framgår ej
Ledbelastningssmärta **efter** kortisoninj.	☐ nej	☐ ja	☐ framgår ej