Occlusal adjustment for treating and preventing temporomandibular joint disorders (Review)

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[Intervention Review]

Occlusal adjustment for treating and preventing temporomandibular joint disorders

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ABSTRACT

Background

There has been a long history of using occlusal adjustment in the management of temporomandibular disorders (TMD). It is not clear if occlusal adjustment is effective in treating TMD.

Objectives

To assess the effectiveness of occlusal adjustment for treating TMD in adults and preventing TMD.

Search methods

We searched the Cochrane Oral Health Group's Trials Register (April 2002); the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2002, Issue 2); MEDLINE (1966 to 8th April 2002); EMBASE (1980 to 8th April 2002) and handsearched journals of particular importance to this review.

Additional reports were identified from the reference lists of retrieved reports and from review articles of treating TMD. There were no language restrictions. Unpublished reports or abstracts were considered from the SIGLE database.

Selection criteria

All randomised or quasi-randomised controlled trials (RCTs) comparing occlusal adjustment to placebo, reassurance or no treatment in adults with TMD. The outcomes were global measures of symptoms, pain, headache and limitation of movement.

Data collection and analysis

Data were independently extracted, in duplicate, by two review authors (Holy Koh (HK) and Peter G Robinson (PR)). Authors were contacted for details of randomisation and withdrawals and a quality assessment was carried out. The Cochrane Collaboration's statistical guidelines were followed and risk ratios calculated using random-effects models where significant heterogeneity was detected ($P < 0.1$).

Main results

Over 660 trials were identified by the initial search. Six of these trials, which reported results from a total of 392 patients, were suitable for inclusion in the review. From the data provided in the published reports, symptom-based outcomes were extracted from trials on treatment. Data on incidence of symptoms were extracted from trials on prevention. Neither showed any difference between occlusal adjustment and control groups.

Authors' conclusions

There is an absence of evidence, from RCTs, that occlusal adjustment treats or prevents TMD. Occlusal adjustment cannot be recommended for the management or prevention of TMD. Future trials should use standardised diagnostic criteria and outcome measures when evaluating TMD.

PLAIN LANGUAGE SUMMARY

Occlusal adjustment for treating and preventing temporomandibular joint disorders

No strong evidence of benefit from occlusal adjustment (adjusting the teeth's biting surfaces) for problems associated with the joint between the lower jaw and skull.

When the joint between the lower jaw and the base of the skull is not working well (temporomandibular disorders (TMD)), it can lead to abnormal jaw movement or locking, noises (clicking or grating), muscle spasms, tenderness or pain. TMD is very common, and might be caused by occlusion (the way the teeth bite), trauma or stress. Treatments include occlusal adjustment, splints, physiotherapy and surgery. Occlusal adjustment involves adjusting the biting surface of teeth by grinding the enamel (outer layer of the tooth). The review found there is no evidence from trials to show that occlusal adjustment can prevent or relieve temporomandibular disorders.

BACKGROUND

The temporomandibular joint (TMJ) is the joint between the lower jaw and the base of the skull. TMJ disorders (TMD) refers to a group of disorders with symptoms that include pain, clicking, grating in the jaw joint and/or problems chewing or opening the jaw. It is also known as craniomandibular disorders (CMD) and is a frequent cause of facial pain problems (Dworkin 1995). A positive relationship between occlusal factors (the way the teeth bite together) and TMD has been suggested (Ramfjord 1961).

Prevalence studies have reported approximately 75% of the population having at least one sign of joint dysfunction (abnormal jaw movement, joint noises, tenderness on palpation, etc) and approximately 33% having at least one symptom (facial pain, joint pain, etc) (Rugh 1985; Schiffman 1988).

There are many causes of TMD. Various theories have been put forward that relate the occlusion (bite of teeth), trauma, and stress with TMD (Bell 1986).

The common signs and symptoms of TMD include pain, joint sounds (clicking, grating), and limited or asymmetrical jaw movement. These symptoms may have an effect on health and quality of life.

Treatment options for TMD include reassurance (patient education, self care and behaviour therapy), physiotherapy (such as ultrasound, Megapulse, acupuncture, short wave diathermy laser, heat exercises, and biofeedback), splint therapy, drug therapy, occlusal adjustment, surgical intervention and combined treatment. Occlusal adjustment (OA) is the selective adjustment of the biting surface of the teeth by grinding the enamel (outer layer of the tooth) so that the upper and lower teeth fit together (the intercuspal position) harmoniously. Adjustments can also be made to ensure that when the lower jaw is moved to one side the teeth on the other side do not touch (non-working side contacts) and that when the lower jaw moves forwards the back teeth do not touch. Cochrane reviews of other treatments (e.g. splint therapy) are underway.

It is not clear if malocclusion has a causal role in TMD. However, OA has been used in studies to prevent TMD. There are ethical and clinical implications if OA is found to be ineffective in preventing TMD.

Only one qualitative systematic review has evaluated OA in treating TMD (Forssell 1999) and it did not include a quantitative assessment.

OBJECTIVES

To establish the effectiveness of occlusal adjustment (OA) in reducing symptoms in patients with temporomandibular disorders (TMD) (compared with any control group receiving no treatment, placebo treatment or reassurance).

The following primary null hypotheses were tested:

OA does not treat or prevent symptoms of TMD.

Specifically, the review addressed the hypotheses of no difference between OA and control for TMD for the following outcomes where data were available:

- global symptoms;
- relief of headache;
- patient quality of life.

METHODS

Criteria for considering studies for this review

Types of studies

All randomised controlled trials (RCTs) including quasi-randomised assessing occlusal adjustment (OA) in temporomandibular disorders (TMD).

Types of participants

Adults aged equal or above 18 years old with clinically diagnosed TMD. There were no age restrictions for prevention trials.
The inclusion criteria required reports to state their diagnostic criteria for TMD and for participant to exhibit two or more of the signs and/or symptoms listed below. This technique is well established in clinical diagnosis and epidemiology and has the principal advantages of objectivity and reliability where no gold standard can exist.
The list of symptoms (Austin 1995) included.

- The occurrence of recurrent headache (equal or more than two episodes a month).
- Pain in the jaws, face, throat, neck, shoulders or back.
- Ear symptoms (includes tinnitus, stuffiness, diminished hearing, or pain).
- Pain in the temporomandibular joint (TMJ) at rest and during chewing.
- Day and night time grinding or clenching.
- Vertigo.
- Stiffness in jaws.
- Difficulties in swallowing.
- Globus symptoms (associated with choking sensations or soreness of the throat).
- Joint sounds (including clicking and grating).
- Spontaneous luxation or locking of the jaws.

The list of signs included.

- Palpatory tenderness on either side of the masticatory muscles.
- Joint sounds during jaw movements, elicited by auscultation. Distinction is made between opening and closing clicks, crepitations and reciprocal clicking.
- Tenderness during jaw movements.
- Deviation of the mandible on opening and closing.
- Reduced mandibular range of motion.
- Presence of occlusal interference in retruded, protruded and medio- and latero-trusion positions of the mandible.
- Wear facets.

TMD was required to be clinically absent at baseline in studies on prevention.

Types of interventions

The treatment group received OA while the control group received no treatment, placebo or reassurance.
Studies where splints had been used prior to treatment were excluded.

Types of outcome measures

Primary outcomes

The main outcomes considered were global symptoms, pain and headache.

- Relief from symptoms was assessed using global measures of symptoms.
- Data on pain were recorded according to frequency, severity or duration. Where possible data for the frequency, severity and duration of pain were aggregated using weighted mean differences (WMD) but depended on assessments of heterogeneity.
- Similarly, data on headache were recorded according to frequency, severity or duration. Where possible data for the frequency, severity and duration of pain were aggregated using WMDs but depended on assessments of heterogeneity.

The interval required for outcome measurement was at least three weeks after the intervention.

Secondary outcomes

Limitation of movement. Other signs were ignored because they are neither unique to the disease nor associated with the progression or outcomes of TMD.

Search methods for identification of studies

There was no language restriction for inclusion. Every effort was made to translate non-English articles into English for inclusion.

Electronic searches

The list of databases searched was as follows:
Cochrane Oral Health Group's Trials Register (to April 2002);
Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* 2002, Issue 2);
MEDLINE (1966 to April 2002);
EMBASE (1980 to April 2002).
To identify randomised controlled trials (RCTs), the search strategy combined the subject search with the Cochrane Optimal Search Strategy (as published in Appendix 5c in the *Cochrane Reviewers' Handbook*). The subject search used a combination of controlled vocabulary and free text terms based on the search strategy for searching MEDLINE (BioMed Ovid 4.1.1) (*see* Appendix 1). Search strategies for other databases were revised appropriately and details of these are available from the lead review author.

Handsearching

The following journals were handsearched:
Journal of Oral Rehabilitation (1974 to April 2002);
Journal of Oral and Maxillofacial Surgery (1982 to April 2002);
Journal of Craniomandibular Practice (1986 to April 2002).

Checking reference lists

Additional reports were identified from the reference lists of retrieved reports and from review articles of temporomandibular disorders treatments.

Unpublished literature

Unpublished reports or abstracts were considered from the SIGLE database (April 2002) using a search strategy based on the search strategy presented above.

Personal communication

When necessary, authors were contacted for relevant original data. Further recommendations were sought from colleagues on unpublished studies.

Data collection and analysis

Study identification

The title, abstract, and key words of identified studies were screened independently by both review authors for relevance to the systematic review. Studies meeting the inclusion criteria were retrieved as complete articles. Those with randomised and quasi-randomised controlled design, participants with temporomandibular disorders (TMD) confirmed clinically, occlusal adjustment and control specified and the required outcome variables were included. The term quasi-randomised studies followed the definition in the Cochrane Oral Health Review Group Journal Handsearchers' Manual and are studies where the method of allocation was known but was not considered strictly random. Non-randomised trials were excluded.

Data extraction

Both review authors independently extracted data from the included studies to a pre-designed data collection form. The data extraction form considered: bibliographic details, details of the study setting, characteristics of study population, frequency and course of the interventions, baseline and outcome measures, etc. The different requirements and techniques for adjustment were recorded as co-variates and assessed as possible sources of heterogeneity. Where available, data on psychosocial factors were included as a co-variate and assessed as a possible source of heterogeneity.
Uncertainties on data extraction were resolved by discussion between the review authors.
Where necessary, the authors of the original studies were consulted by mail to obtain more information about the published study.
Agreement between review authors was assessed using Cohen's Kappa.

Quality assessment

Both review authors independently assessed the quality of each study according to the guidelines in the *Cochrane Reviewers' Handbook*. The strengths and weaknesses of the study design of each included study were analysed. The allocation concealment of each study was graded as A (adequate), B (unclear), C (inadequate) or D (allocation concealment not used). Disagreements on validity assessment were resolved by consensus and discussion.

Data analysis

The Cochrane Collaboration's statistical guidelines were followed. Review Manager (RevMan) software was used for data processing. Cochran's test for heterogeneity was used to assess discrepancies in the estimates of treatment effects. A random-effects model was

used for assessment of any significant heterogeneity (P < 0.1) detected. The source of any statistical heterogeneity was investigated. The studies were grouped according to types of control and duration of follow up. A sensitivity analysis was carried out upon different assumptions such as quality of the studies, whether the trials were blind or not, missing data and different statistical approaches.

The different requirements and techniques for adjustment were recorded as co-variate and assessed as possible sources of heterogeneity. Where available, psychosocial factors were included as a co-variate and assessed as a possible source of heterogeneity.

The proportion of observed and expected agreement between the review authors for 45 variables was assessed using Cohen's Kappa.

Publication bias was estimated using the symmetry of funnel plots.

The strength and generalisability of the evidence were carefully explained.

Any adverse reactions were recorded and described.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

See Characteristics of included studies table.

See Characteristics of excluded studies table.

Characteristics of trial setting and investigators

Of the 17 eligible trials, 11 trials were excluded for the following reasons: attrition bias (three trials), incomparable duration of intervention and measurement (two trials), two trials of treatment for temporomandibular disorders (TMD) had control groups that did not have the condition, no valid control group (two trials), invalid treatment group (one trial) and inadequate duration of measurement (one trial).

Of the six included trials, four were conducted in Finland (Karjalainen 1997; Kirveskari 1985; Kirveskari 1989; Kirveskari 1998), one in the USA (Kerstein 1997) and one in Sweden (Vallon 1991). All trials had a randomised, parallel group study design. The trials were published in six reports between 1985 and 1998, with two trials published in 1997, one in 1998, one in 1991, one in 1989 and one trial in 1985. One study had more than one publication (Kirveskari 1985). Two of the trials (Karjalainen 1997; Kirveskari 1998) received external funding, four trials did not. The percentage of patients lost to follow up ranged from 0% to 23%, with a median value of 11%. One study (Vallon 1991) reported no drop outs. One trial (Kerstein 1997) did not have a blind outcome assessment.

Characteristics of participants

Three trials (Kerstein 1997; Kirveskari 1985; Vallon 1991) recruited patients with symptoms of TMD for treatment.

For prevention, three trials (Karjalainen 1997; Kirveskari 1989; Kirveskari 1998) recruited only healthy subjects. Of these, one trial included young adults, one trial included adolescents and one study included children and adolescents.

Characteristics of interventions

There were two groups of trials for assessment. One group considered the intervention in treating patients with TMD. The other group of trials considered the prevention of TMD using occlusal adjustment.

All of the six trials provided a clear description of the type and duration of intervention for both the test and control groups. All but one trial (Vallon 1991) included a placebo control group. One trial compared adjustment and reassurance (Vallon 1991). One trial had an additional 'no treatment' control group (Kerstein 1997) besides the test and placebo groups.

Characteristics of outcome measures

Three trials reported both signs and symptoms of TMD (Kerstein 1997; Kirveskari 1985; Vallon 1991). There was variation between the trials in the assessment of symptoms for TMD. Two trials (Kerstein 1997; Vallon 1991) reported data on pain and headache. Two trials presented data on globus (Kirveskari 1985; Vallon 1991).

There was variation in the type of measurement used for the main outcomes. One trial used a Visual Analogue Scale for pain and the presence or absence of headache and globus (Vallon 1991). One trial used the frequency and intensity of pain and headache (Kerstein 1997). One trial used number of improvements in globus symptoms (Kirveskari 1985).

The three studies on prevention (Karjalainen 1997; Kirveskari 1989; Kirveskari 1998) reported data on the incidence of TMD. Additional clinical outcomes reported included range of mandibular movement (Vallon 1991), disclusion times (Kerstein 1997) and the presence of an unstable occlusion (Kirveskari 1985). There were no data on psychosocial outcomes, costs or quality of life in any of the trials. There were no reports of adverse reactions.

Approval from an ethical committee was reported in all except two trials (Kerstein 1997; Kirveskari 1985).

Two trials (Karjalainen 1997; Kirveskari 1998) had a peer-reviewed grant while the remaining trials did not report about funding.

Risk of bias in included studies

Electronic mails were sent to authors of one trial and data were obtained from one included study (Kirveskari 1998). The information supplied was from questionnaires administered pre- and post-treatment regarding symptoms in subjects who did not request treatment.

Selection bias

No major differences were found in the baseline characteristics of the groups in terms of the number randomised, age, gender or the outcomes in Kirveskari 1998; Vallon 1991. It was unclear if differences in the age and gender existed in one trial (Kirveskari 1985), age alone in one trial (Kirveskari 1989) and gender alone in two trials (Karjalainen 1997; Kerstein 1997). There were no major differences in the other baseline characteristics.

The generation of allocation was adequate in three trials (Kirveskari 1985; Kirveskari 1998; Karjalainen 1997), inadequate in one trial (Kerstein 1997) and unclear in two trials (Kirveskari 1989; Vallon 1991).

Performance bias

All the trials were performed by dentists trained in occlusal adjustment and control. Adjustment for confounders was either absent or unclear in all trials.

The concealment of allocation was inadequate for one of the six trials (Kerstein 1997) and it was unclear for the remaining five.

Attrition bias

Data were analysed on an intention-to-treat basis in all except two trials (Kirveskari 1985; Vallon 1991). The withdrawals were adequately reported in four trials, unclear in one trial (Kerstein 1997). One trial did not have any withdrawals (Vallon 1991).

Detection bias

All but one trial (Kerstein 1997) reported blinding during the outcome assessment.

Effects of interventions

The search strategy identified over 660 titles and abstracts and from this we obtained 23 full reports. Seventeen trials were considered eligible according to the defined criteria for trial design, participants, interventions and outcomes. Of the 17, 11 trials were excluded for the following reasons: no oral outcome (14 trials), no useable outcome or data in wrong form (five trials), the data were presented as episodes not patients (eight trials), two reports with insufficient information and one study where it was unclear if it was a randomised clinical trial or not.

For the six trials included in the review the results are based on 391 patients who were assessed for temporomandibular disorders (TMD). There were 92 patients in the treatment trials and 299 in the prevention trials. The range of patients was from 9 to 74 per treatment/control group.

The proportion of observed and expected agreement between the review authors for 45 variables in all 17 data extraction forms was assessed using Cohen's Kappa. The test showed a high agreement between the review authors (K = 0.88).

The outcomes in the studies for treatment of TMD were severity of pain, frequency of pain, severity of headache, frequency of headache and relief of globus (all one study each). Occlusal adjustment (OA) did not significantly reduce any of these symptoms (*see* 'Data and analyses' Comparisons 1 to 3).

The outcomes in the three studies for preventing TMD were incidence of symptoms. OA did not significantly reduce the incidence of these symptoms (*see* 'Data and analyses' Comparison 4, Outcome 4.1).

There were no data on psychosocial outcomes, costs and quality of life.

Heterogeneity

Heterogeneity was assessed for the incidence of symptoms in the prevention trials (Comparison 4, Outcome 4.1). The meta-analysis shows overlap in the confidence intervals and suggests that the variation in the results was not due to chance (P = 0.05).

Publication bias

Publication bias was assessed for the incidence of symptoms in the prevention trials (Comparison 4, Outcome 4.1). The funnel plot is based on three studies and is insufficiently powerful for any clear indication. The other comparisons had only one trial.

The following decisions and assumptions were examined in the sensitivity analyses:

- changing the inclusion criteria for the duration of study;
- reanalysing the data inputing a continuous outcome instead of a dichotomous outcome;
- reanalysing the data using improvement of symptoms rather than the absence;
- reanalysing the data using random-effects models instead of a fixed effect model or vice versa;
- reanalysing the data by aggregating the data from the placebo, reassurance and no treatment groups;
- reanalysing the data by aggregating the data relating to frequency and severity of pain or headache.

The results of the sensitivity analyses were not statistically significant (P > 0.05).

DISCUSSION

There is an absence of evidence that occlusal adjustment (OA) treats or prevents temporomandibular disorders (TMD). Data available in the six trials indicate no significant differences between OA and placebo, reassurance or no treatment in the treatment or prevention of TMD.

It is important to distinguish between absence of evidence and evidence of absence. There may not be evidence of an effect because there are few data regarding the effectiveness of occlusal adjustment for TMD. The small number of studies and participants meant that the confidence intervals (CIs) were wide. An implication is that more trials on the effectiveness of occlusal adjustment for TMD are needed.

Based on these data OA cannot be recommended in the treatment and prevention of TMD.

The inclusion of future trials on prevention into the current analysis may further reduce the confidence interval and achieve statistical significance.

There are concerns of the validity and reliability of the criteria used in the trials. Inaccurate and inconsistent diagnosis of TMD would cause misleading reporting of TMD and incomparability of results with other trials.

Although the sensitivity analyses do not materially change the results of the review, there are too few trials, of low quality and with few participants, for the results to be robust.

There were some limitations of the methods used in the trials. These limitations should be considered in their historical context. Recommendations for future research include.

(1) Reporting the odds ratio, risk ratio, relative risk reduction, absolute risk reduction or weighted mean difference and associated 95% CIs where appropriate.

(2) Reporting data on psychosocial outcomes, costs and quality of life.

(3) The use of standardised diagnostic criteria for TMD.

(4) The use of standardised outcome measures for evaluating treatments of TMD.

(5) Reporting of any side effects, especially if they were directly related to the intervention.

(6) Providing intra- or extra-examiner variability where appropriate.

(7) Future research should use samples of adequate size based on power calculations. The existing trials should be used as the basis of such power calculations.

AUTHORS' CONCLUSIONS

Implications for practice

There is an absence of evidence of effectiveness for occlusal adjustment (OA). Based on these data OA cannot be recommended for the treatment or prevention of temporomandibular disorders (TMD).

Implications for research

(1) More research is needed to elucidate whether there is any benefit from treating TMD with occlusal adjustment.

(2) Consideration needs to be given to developing valid and standardised diagnostic criteria for TMD.

(3) Consideration needs to be given to standardised outcome measurements for evaluating interventions for TMD.

(4) There should be more trials reporting cost-outcome comparisons of different treatment modalities. The analysis could also include the opportunity costs of using a particular intervention over other alternatives.

(5) Guidelines, produced by the CONSORT Group, have been published for reporting of randomised controlled trials in the medical literature (CONSORT 2001). The use of such guidelines would improve the quality of trials and reports of the management of TMD.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Karjalainen 1997

Methods	Randomised, parallel group study conducted in Finland. Blind outcome assessment. Clear information on reasons for withdrawal. Drop outs: 4%
Participants	Healthy adolescents and treated orthodontically. 123 eligible patients, with 118 completing
Interventions	2 groups, adjustment versus placebo. 3 visits (intervention for first 2 visits, measurement 3 years after intervention). Duration: 3 years
Outcomes	Incidence of symptom after 3 years. Other outcomes: symptoms of pain, headache and globus
Notes	Prevention.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Kerstein 1997

Methods	Randomised, parallel group study conducted in USA. Outcome assessment not blind. Unclear information on reasons for withdrawal. Drop outs: 17%
Participants	Dental students with myofascial pain. 30 eligible patients, with 25 completing
Interventions	3 groups, adjustment, no treatment versus placebo. 4 visits (intervention for first 2 visits, measurement at 1 month and 6 months after intervention). Duration: 6 months
Outcomes	Symptoms of pain (severity and frequency) and headache (severity and frequency). Other outcomes: disclusion times.
Notes	Treatment.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Kirveskari 1985

Methods	Randomised, parallel group study conducted in Finland. Blind outcome assessment. Clear information on reasons for withdrawal. Drop outs: 23%
Participants	Patients with globus. 22 eligible patients, with 17 completing
Interventions	2 groups, adjustment versus placebo. 2-7 visits (intervention for first 2-6 visits, measurement 2-3 months after intervention). Duration: 2-3 months
Outcomes	Symptoms of globus (relief). Other outcomes: muscular tenderness and mandibular range.
Notes	Treatment.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Kirveskari 1989

Methods	Randomised, parallel group study conducted in Finland. Blind outcome assessment. Clear information on reasons for withdrawal. Drop outs: 5%
Participants	Young adults without temporomandibular disorders. 65 eligible patients, with 62 completing
Interventions	2 groups, adjustment versus placebo. 3-4 visits (intervention for first 2-3 visits, measurement 2 years after intervention). Duration: 2 years
Outcomes	Incidence of symptom after 2 years. Other outcomes: mean range of mandibular movement
Notes	Prevention.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Kirveskari 1998

Methods	Randomised, parallel group study conducted in Finland. Blind outcome assessment. Clear information on reasons for withdrawal. Drop outs: 18%
Participants	Healthy chidren and adolescents. 146 eligible patients, with 119 completing

Kirveskari 1998 (*Continued*)

Interventions	2 groups, adjustment versus placebo. 4 or more visits (interventions within 2 weeks, measurements every 6 months thereafter). Duration: 4 years
Outcomes	Incidence of symptom after 4 years. Other outcomes: muscular tenderness
Notes	Prevention.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Vallon 1991

Methods	Randomised, parallel group study conducted in Sweden. Blind outcome assessment. No withdrawal. Drop outs: 0%
Participants	Patients with craniomandibular disorders. 64 eligible patients, with 50 completing
Interventions	2 groups, adjustment versus placebo. 3 visits (intervention 2 weeks after examination, measurement 4 weeks after intervention). Duration: 4 weeks
Outcomes	Symptoms of pain (frequency), headache (frequency) and globus (relief). Other outcomes: muscular tenderness
Notes	Treatment.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Forssell 1986	Incomparable duration of intervention and measurement.
Forssell 1987	Follow up to Forssell 1986. Not randomised.
Karppinen 1999	Treatment group did not have temporomandibular joint disorders

(*Continued*)

Kopp 1979	Treatment group received adjustment, splints, partial dentures and/or occlusal correction. Not all had adjustment
Puhakka 1988	Treatment group had globus but no temporomandibular joint disorders
Tsolka 1992	Insufficient duration of the study. Results were recorded 10 days after treatment
Vallon 1995	Attrition bias.
Vallon 1997	Follow up to Vallon 1995. Attrition bias.
Vallon 1998	Follow up to Vallon 1995. Attrition bias and combined groups
Wenneberg 1988	No placebo, no treatment or reassurance as control group.
Werndahl 1971	Both groups had reassurance. Reassurance group additionally received muscle exercise

DATA AND ANALYSES

Comparison 1. Occlusal adjustment vs placebo

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain (frequency)	1	18	Odds Ratio (M-H, Fixed, 95% CI)	0.5 [0.07, 3.85]
2 Pain (severity)	1	18	Odds Ratio (M-H, Fixed, 95% CI)	0.5 [0.07, 3.85]
3 Headache (frequency)	1	18	Odds Ratio (M-H, Fixed, 95% CI)	0.90 [0.13, 6.08]
4 Headache (severity)	1	18	Odds Ratio (M-H, Fixed, 95% CI)	0.90 [0.13, 6.08]
5 Relief of globus	1	17	Odds Ratio (M-H, Fixed, 95% CI)	6.0 [0.72, 49.84]

Comparison 2. Occlusal adjustment vs reassurance

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain (frequency)	1	50	Odds Ratio (M-H, Fixed, 95% CI)	0.13 [0.01, 2.58]
2 Headache (frequency)	1	50	Odds Ratio (M-H, Fixed, 95% CI)	1.40 [0.45, 4.35]
3 Overall symptoms improvement	1	50	Odds Ratio (M-H, Fixed, 95% CI)	3.12 [0.12, 80.39]

Comparison 3. Occlusal adjustment vs no treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain (frequency)	1	17	Odds Ratio (M-H, Fixed, 95% CI)	0.10 [0.00, 2.15]
2 Pain (severity)	1	17	Odds Ratio (M-H, Fixed, 95% CI)	0.10 [0.00, 2.15]
3 Headache (frequency)	1	17	Odds Ratio (M-H, Fixed, 95% CI)	0.10 [0.00, 2.15]
4 Headache (severity)	1	17	Odds Ratio (M-H, Fixed, 95% CI)	0.10 [0.00, 2.15]

Comparison 4. Prevention of TMD

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Incidence of symptoms	3	300	Odds Ratio (M-H, Random, 95% CI)	0.43 [0.14, 1.37]

Analysis 1.1. Comparison 1 Occlusal adjustment vs placebo, Outcome 1 Pain (frequency).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 1 Occlusal adjustment vs placebo

Outcome: 1 Pain (frequency)

Study or subgroup	Adjustment n/N	Placebo n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Kerstein 1997	6/10	6/8		100.0 %	0.50 [0.07, 3.85]
Total (95% CI)	**10**	**8**		**100.0 %**	**0.50 [0.07, 3.85]**
Total events: 6 (Adjustment), 6 (Placebo)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.67 (P = 0.51)					

Analysis 1.2. Comparison 1 Occlusal adjustment vs placebo, Outcome 2 Pain (severity).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 1 Occlusal adjustment vs placebo

Outcome: 2 Pain (severity)

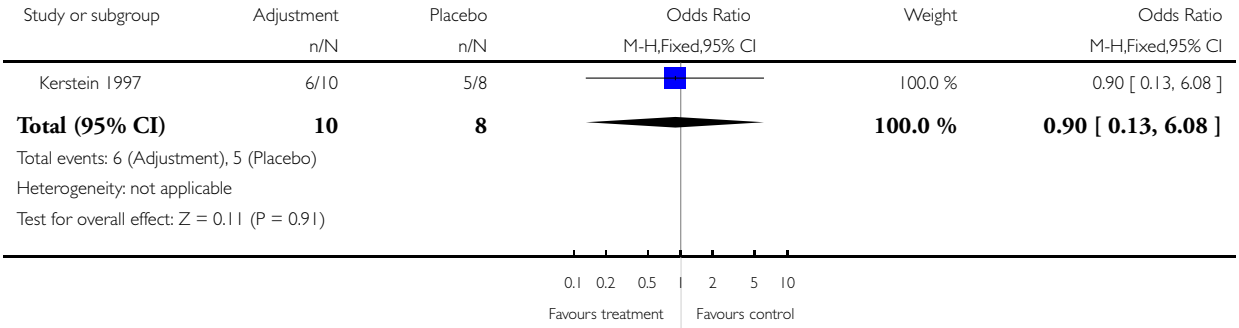
Study or subgroup	Adjustment n/N	Placebo n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Kerstein 1997	6/10	6/8		100.0 %	0.50 [0.07, 3.85]
Total (95% CI)	**10**	**8**		**100.0 %**	**0.50 [0.07, 3.85]**
Total events: 6 (Adjustment), 6 (Placebo)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.67 (P = 0.51)					

Analysis 1.3. Comparison 1 Occlusal adjustment vs placebo, Outcome 3 Headache (frequency).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 1 Occlusal adjustment vs placebo

Outcome: 3 Headache (frequency)

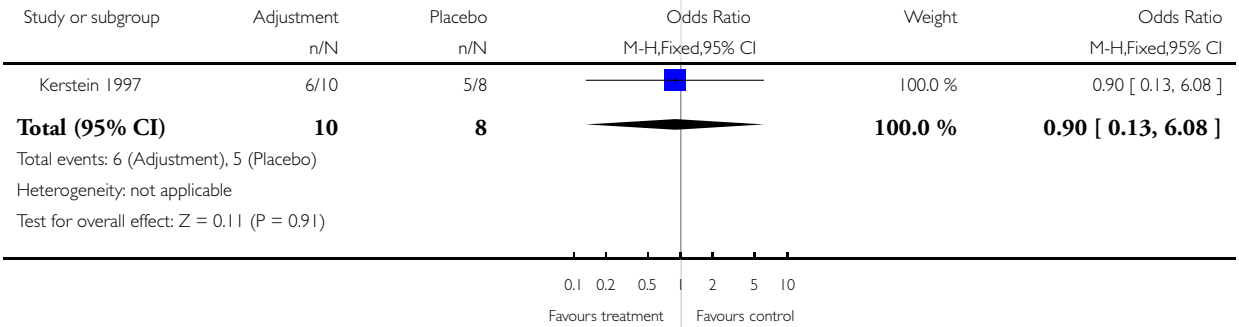


Analysis 1.4. Comparison 1 Occlusal adjustment vs placebo, Outcome 4 Headache (severity).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 1 Occlusal adjustment vs placebo

Outcome: 4 Headache (severity)



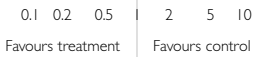
Analysis 1.5. Comparison 1 Occlusal adjustment vs placebo, Outcome 5 Relief of globus.

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 1 Occlusal adjustment vs placebo

Outcome: 5 Relief of globus

Study or subgroup	Adjustment n/N	Placebo n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Kirveskari 1985	6/8	3/9		100.0 %	6.00 [0.72, 49.84]
Total (95% CI)	**8**	**9**		**100.0 %**	**6.00 [0.72, 49.84]**
Total events: 6 (Adjustment), 3 (Placebo)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.66 (P = 0.097)					



Analysis 2.1. Comparison 2 Occlusal adjustment vs reassurance, Outcome 1 Pain (frequency).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 2 Occlusal adjustment vs reassurance

Outcome: 1 Pain (frequency)

Study or subgroup	Adjustment n/N	Reassurance n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Vallon 1991	22/25	25/25		100.0 %	0.13 [0.01, 2.58]
Total (95% CI)	**25**	**25**		**100.0 %**	**0.13 [0.01, 2.58]**
Total events: 22 (Adjustment), 25 (Reassurance)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.35 (P = 0.18)					

Analysis 2.2. Comparison 2 Occlusal adjustment vs reassurance, Outcome 2 Headache (frequency).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 2 Occlusal adjustment vs reassurance

Outcome: 2 Headache (frequency)

Study or subgroup	Adjustment n/N	Reassurance n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Vallon 1991	11/25	9/25		100.0 %	1.40 [0.45, 4.35]
Total (95% CI)	**25**	**25**		**100.0 %**	**1.40 [0.45, 4.35]**
Total events: 11 (Adjustment), 9 (Reassurance)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.58 (P = 0.56)					

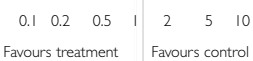
Analysis 2.3. Comparison 2 Occlusal adjustment vs reassurance, Outcome 3 Overall symptoms improvement.

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 2 Occlusal adjustment vs reassurance

Outcome: 3 Overall symptoms improvement

Study or subgroup	Adjustment n/N	Reassurance n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Vallon 1991	1/25	0/25		100.0 %	3.12 [0.12, 80.39]
Total (95% CI)	**25**	**25**		**100.0 %**	**3.12 [0.12, 80.39]**
Total events: 1 (Adjustment), 0 (Reassurance)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.69 (P = 0.49)					



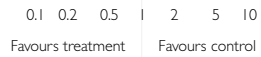
Analysis 3.1. Comparison 3 Occlusal adjustment vs no treatment, Outcome 1 Pain (frequency).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 3 Occlusal adjustment vs no treatment

Outcome: 1 Pain (frequency)

Study or subgroup	Adjustment n/N	no treatment n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Kerstein 1997	6/10	7/7		100.0 %	0.10 [0.00, 2.15]
Total (95% CI)	**10**	**7**		**100.0 %**	**0.10 [0.00, 2.15]**
Total events: 6 (Adjustment), 7 (no treatment)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.48 (P = 0.14)					



Analysis 3.2. Comparison 3 Occlusal adjustment vs no treatment, Outcome 2 Pain (severity).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 3 Occlusal adjustment vs no treatment

Outcome: 2 Pain (severity)

Study or subgroup	Adjustment n/N	no treatment n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Kerstein 1997	6/10	7/7		100.0 %	0.10 [0.00, 2.15]
Total (95% CI)	**10**	**7**		**100.0 %**	**0.10 [0.00, 2.15]**
Total events: 6 (Adjustment), 7 (no treatment)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.48 (P = 0.14)					

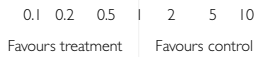
Analysis 3.3. Comparison 3 Occlusal adjustment vs no treatment, Outcome 3 Headache (frequency).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 3 Occlusal adjustment vs no treatment

Outcome: 3 Headache (frequency)

Study or subgroup	Adjustment n/N	no treatment n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Kerstein 1997	6/10	7/7		100.0 %	0.10 [0.00, 2.15]
Total (95% CI)	**10**	**7**		**100.0 %**	**0.10 [0.00, 2.15]**
Total events: 6 (Adjustment), 7 (no treatment)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.48 (P = 0.14)					



Analysis 3.4. Comparison 3 Occlusal adjustment vs no treatment, Outcome 4 Headache (severity).

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 3 Occlusal adjustment vs no treatment

Outcome: 4 Headache (severity)

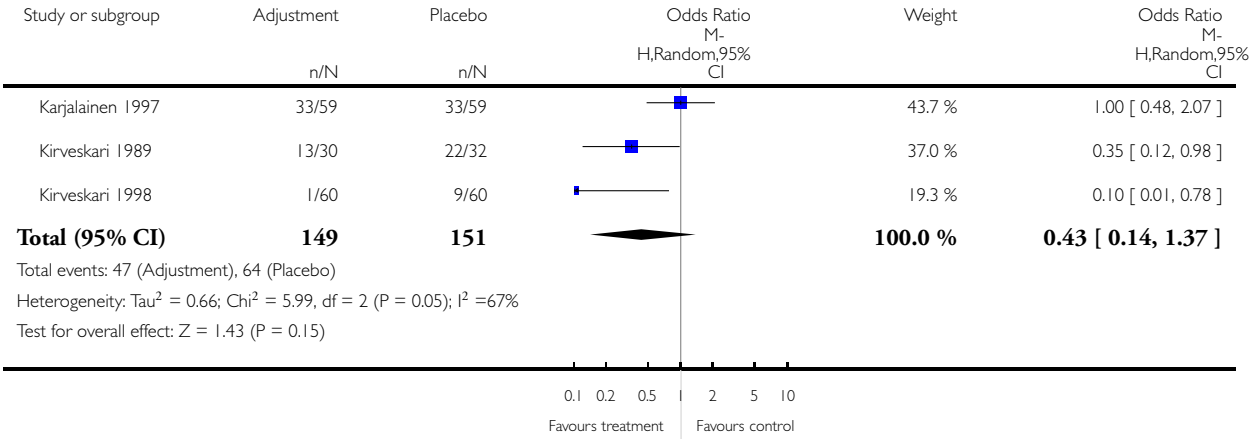
Study or subgroup	Adjustment n/N	no treatment n/N	Odds Ratio M-H,Fixed,95% CI	Weight	Odds Ratio M-H,Fixed,95% CI
Kerstein 1997	6/10	7/7		100.0 %	0.10 [0.00, 2.15]
Total (95% CI)	**10**	**7**		**100.0 %**	**0.10 [0.00, 2.15]**
Total events: 6 (Adjustment), 7 (no treatment)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.48 (P = 0.14)					

Analysis 4.1. Comparison 4 Prevention of TMD, Outcome 1 Incidence of symptoms.

Review: Occlusal adjustment for treating and preventing temporomandibular joint disorders

Comparison: 4 Prevention of TMD

Outcome: 1 Incidence of symptoms



APPENDICES

Appendix 1. MEDLINE (OVID) search strategy

1 exp Temporomandibular Joint/ or exp Temporomandibular Joint Disorders/
2 exp Temporomandibular Joint Dysfunction Syndrome/
3 exp Myofascial Pain Syndromes/
4 exp Craniomandibular Disorders/
5 temporomandibular$.mp. [mp=title, abstract, registry number word, mesh subject heading]
6 craniomandibular$.mp. [mp=title, abstract, registry number word, mesh subject heading]
7 tmj$.mp. [mp=title, abstract, registry number word, mesh subject heading]
8 cmd$.mp. [mp=title, abstract, registry number word, mesh subject heading]
9 "temporo mandibular".mp. [mp=title, abstract, registry number word, mesh subject heading]
10 temporo-mandibular$.mp. [mp=title, abstract, registry number word, mesh subject heading]
11 ("cranio mandibular" or cranio-mandibular).mp. [mp=title, abstract, registry number word, mesh subject heading]
12 tmd$.mp. [mp=title, abstract, registry number word, mesh subject heading]
13 exp Joint Diseases/
14 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13
15 exp Dental Occlusion, Balanced/
16 exp Occlusal Adjustment/
17 (occlus$ adj5 (balance$ or treatment$ or equilibrat$ or adjust$)).mp. [mp=title, abstract, registry number word, mesh subject heading]
18 ((tooth or teeth) adj5 grind$).mp. [mp=title, abstract, registry number word, mesh subject heading]

19 (bite$ adj5 adjust$).mp. [mp=title, abstract, registry number word, mesh subject heading]
20 (occlus$ adj5 (balance$ or treat$ or equilibrat$ or adjust$)).mp. [mp=title, abstract, registry number word, mesh subject heading]
21 (bite$ adj5 (adjust$ or correct$ or modif$)).mp. [mp=title, abstract, registry number word, mesh subject heading]
22 (occlus$ adj5 (correct$ or modif$)).mp. [mp=title, abstract, registry number word, mesh subject heading]
23 exp Dental Occlusion/
24 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23
25 14 AND 24

WHAT'S NEW

Last assessed as up-to-date: 12 November 2002.

Date	Event	Description
15 October 2008	Amended	Converted to new review format.

HISTORY

Protocol first published: Issue 3, 2002

Review first published: Issue 1, 2003

CONTRIBUTIONS OF AUTHORS

Holy Koh (HK) and Peter G Robinson (PR) wrote the protocol and review. PR co-ordinated the review and wrote the letters to authors. HK and PR independently and in duplicate assessed the eligibility of trials, extracted data and assessed the quality of trials. HK conducted the statistical analysis.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Guy's, King's and St Thomas' School of Dentistry, UK.
- University of Sheffield , School of Dentistry, UK.

External sources

- No sources of support supplied

INDEX TERMS

Medical Subject Headings (MeSH)

*Occlusal Adjustment; Randomized Controlled Trials as Topic; Temporomandibular Joint Disorders [prevention & control; *therapy]

MeSH check words

Adult; Humans