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Review

Temporomandibular Disorders in Patients Undergoing Mandibular Advancement Device Therapy for Obstructive Sleep Apnea: A Systematic Review

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Abstract

Background: Mandibular advancement device (MAD) therapy is a popular and effective treatment for snoring and obstructive sleep apnea (OSA). However, there have been several reports in the literature of patients developing temporomandibular disorders (TMDs).

Objective: The objective of this review is to evaluate the prevalence of TMD, both in the initial phase of therapy and at follow up appointments, amongst patients wearing a MAD for OSA.

Methods: The authors conducted a systematic review of published articles in which the presence of TMDs in patients undergoing MAD therapy for OSA was investigated. Eligible studies met the following criteria: a diagnosis of TMD following mandibular advancement using a custom-made and titratable MAD using either the Diagnostic Criteria for TMD (DC/TMD), Helkimo Anamnestic Dysfunction Index or reproducible clinical signs/symptoms. Of the thirty-six articles published in this area, eleven were included in this review. These were assessed in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines.

Results: The average prevalence of TMD during the initial phase of MAD therapy was found to be 25%. The prevalence of TMD reduced in the follow up periods. The adherence to MAD, especially long term, appears to be variable and from our results, it appears an average of 20% of patients discontinue MAD therapy over six to one hundred and twenty months, and this number has been reported to be as high as 62.5% (over 58 months).

Conclusions: There was some difficulty in comparing the studies due to the differences in follow up time, methodology, sample size and diagnostic criteria. Longer clinical follow-up studies, with an objective method of monitoring patient adherence such as home monitoring devices, and preferably with a larger sample size

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are needed to evaluate the long-term effects of MADs on the TMD. The authors consider it prudent for clinicians to counsel patients that a small number will experience signs and symptoms of TMD with MAD use. However TMD is usually transient and the long-term risk appears small. In patients who develop TMD during MAD therapy, treatment of their TMD is recommended to prevent discontinuation of MAD therapy. In a few patients, persistent TMD may result in discontinuation of MAD therapy. Patients should be cautioned of this possibility and subsequently referred to consider other treatment options for their OSA.

Keywords: Temporomandibular Disorders; Mandibular Advancement Therapy; Mandibular Advancement Device; Obstructive Sleep Apnoea; Sleep Apnea

1. Introduction

Obstructive sleep apnea (OSA), a sleep disorder characterized by recurring collapse of the upper airway during sleep, is defined by the occurrence of five or more episodes of complete (apnea) or partial (hypopnea) upper airway obstruction per hour of sleep (Sutherland et al., 2014). OSA, and resultant sleep fragmentation and oxygen desaturation, have been associated with daytime sleepiness, cognitive impairment, type 2 diabetes, cardiovascular disease, stroke, increased risk of motor vehicle accidents and can have significant effects on quality of life (Chen et al., 2008; Cunali et al., 2008; Sutherland et al., 2014; Vuorjoki-Ranta et al., 2014). It can affect 4% to 9% of the middle-aged population, and some studies report an incidence as high as 34% in men (Clark et al., 2000; Cunali et al., 2008). Sufferers require an effective and long-term treatment.

The gold standard treatment for OSA is to pneumatically splint the upper airway during sleep using continuous positive airway pressure (CPAP) (Sutherland et al., 2014). Although CPAP is highly efficacious in preventing upper airway collapse, providing a successful outcome in over 95 % of users, as many as 50 % of patients cannot tolerate the use of CPAP (Perez et al., 2013; Sutherland et al., 2014). Hence many patients look toward alternative treatment options, such as the use of a mandibular advancement device (MAD).

The current clinical practice guideline of the American Academy of Sleep Medicine (AASM) and American Academy of Dental Sleep Medicine (AADSM) recommends that adult patients without OSA, who request treatment of primary snoring, be prescribed oral appliances, rather than no therapy (Ramar et al., 2015). For adult patients with OSA, both oral appliances and CPAP can significantly reduce the apnea-hypopnea index/respiratory disturbance index/respiratory event index (AHI/RDI/REI) across all levels of OSA severity in adult patients (Ramar et al., 2015). CPAP remains first-line therapy for the treatment of adult patients with severe OSA; however, it is recommended that patients who are intolerant of CPAP therapy or prefer alternate therapy be provided with an oral appliance, rather than no treatment (Ramar et al., 2015). Though there is limited evidence for further recommendations, based on a single retrospective study by Holley in 2011, there was no significant difference in the percentage of mild OSA patients achieving their target AHI/RDI/REI (< 5, < 10, > 50% reduction) after treatment between OAs and CPAP (Ramar et al., 2015). MAD use instead of CPAP therapy may prove to be more acceptable for patients with chronically impaired nasal ventilation, frequent travelers who prefer the convenience of a MAD, and for residents of areas where electrical power is not available (Mehta et al., 2001; Napankangas et al., 2012).

The MAD aims to create a widening of the upper airway configuration by posturing the mandible forward. This action changes the dimensions of the upper airway, including the hypopharynx, the oropharynx, and the nasopharynx, and imaging studies have shown that the upper airway space expands, most notably in the lateral dimension of the velopharyngeal region (Bondemark, 1999; Sutherland et al., 2014). It has been also hypothesized that MADs increase muscular tonus by increasing the passive muscle tension in the pharyngeal wall, thereby reducing the vibration of the soft tissues and the turbulent airflow (Hammond et al., 2007). Assessment of pharyngeal collapsibility during mandibular advancement therapy has also shown a dose-dependent effect in improvement of upper airway closing pressures (Sutherland et al., 2014). When oral appliance therapy is prescribed for an adult patient with OSA, a custom, titratable appliance is recommended (Ramar et al., 2015).

Although MAD therapy has been shown to be effective in the treatment of OSA, its use may be associated with side effects. Beneficial treatment effects may be reduced by treatment-related side effects, and ultimately the lack of adherence to treatment (Ramar et al., 2015). Excessive salivation, dry mouth, and pain or discomfort in the supporting teeth, oral mucosa, masticatory muscle, and temporomandibular joint (TMJ) have been reported as temporary side effects during short and medium periods of oral appliance use (Mehta et al., 2001; Hammond et al., 2007; Cunali et al., 2009; Marklund, 2015)

Long-term side effects include occlusal changes without the presence of pain, and skeletal changes (Cunali et al., 2009; Marklund, 2015) Most of these short to medium term side effects are transient and often treatable (Cunali et al., 2009; Hammond et al., 2007). It is purported that by inducing a forward and downward position of the mandible and maintaining it in a non-habitual position during sleep, the harmony of the stomatognathic system is potentially affected, with subsequent development of signs and symptoms of TMD (Mehta et al., 2011; Napankangas et al., 2012; De Leeuw and Klasser, 2013; Perez at el., 2013).

The American Academy of Orofacial Pain (AAOP) defines TMD as "a collective term for a group of musculoskeletal and neuromuscular conditions which includes several clinical signs and symptoms involving the muscles of mastication, the TMJ, and associated structures (De Leeuw and Klasser, 2013). In a recent update, the American Academy of Orofacial Pain divided TMD in two broad categories: TMJ disorders and masticatory muscle disorders (De Leeuw and Klasser, 2013). TMD affects 5% to 12% of the population, and typically affects the middle-aged population, occurring more frequently in women (Cunali et al., 2009; Doff et al., 2012).

These disorders are principally characterized by pain in the temporomandibular region or in the muscles of mastication, functional limitations or deviations in mandibular range of motion and TMJ sounds during jaw function (Carrara et al., 2010; Napankangas, 2012). The symptoms most often reported by patients include pain in the face, TMJ, masticatory muscles and pain in the head and ear (Carrara et al., 2010; Napankangas, 2012). The signs are primarily muscle and TMJ tenderness to palpation, limitation and/or incoordination of mandibular movements and joint noises (Carrara et al., 2010). The presence of TMD may result in poor adherence or even discontinuation of treatment. Hence its early diagnosis and treatment is necessary.

This systematic review evaluates the prevalence of TMD, a known side effect in patients with OSA after the commencement of MAD therapy, and also to establish whether the TMD is transient in this group of patients. The presence of TMD may result in poor adherence or even discontinuation of treatment. Hence its early diagnosis and treatment is necessary to improved adherence to treatment.

2. Methods

The authors conducted a systematic review of published papers in which the presence of TMDs in patients undergoing MAD therapy for OSA was investigated.

2.1 Eligibility criteria

Eligible studies met the following criteria: diagnosis of TMD following MAD using a MAD, using the Diagnostic Criteria for TMD (DC/TMD), Helkimo Anamnestic Dysfunction Index or clinical signs/symptoms. As there were several MAD designs employed in the studies, only devices with a minimum of 50% initial advancement of the device were included.

2.2 Information sources and search

We conducted a computerized search of databases Medline, PubMed, the Cochrane Library database and Google Scholar for papers published from 1965 through to January 2016, using the search terms 'Temporomandibular Disorders' AND/OR 'Mandibular Advancement' AND/OR 'Anterior Repositioning' AND/OR 'Oral Appliance Therapy' AND 'Obstructive Sleep Apnoea/Apnea'.

2.2 Study selection

One reviewer searched titles and abstracts of identified published citations in the search results. Also the reference lists of these articles were searched. Thirty-six studies were screened. After the eligibility criteria were applied, eleven studies were found suitable and these were reviewed in its entirety. These were assessed in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines.

Using standardized forms, the primary author extracted data from the studies independently, which included number of participants at the beginning and end of the study, demographic information and gender of participants, methodology and how the diagnosis of TMD was reached, its prevalence, MAD design, and whether the patients judged the outcome to be beneficial.

There was substantial diversity found in the outcome measures used among eligible trials.

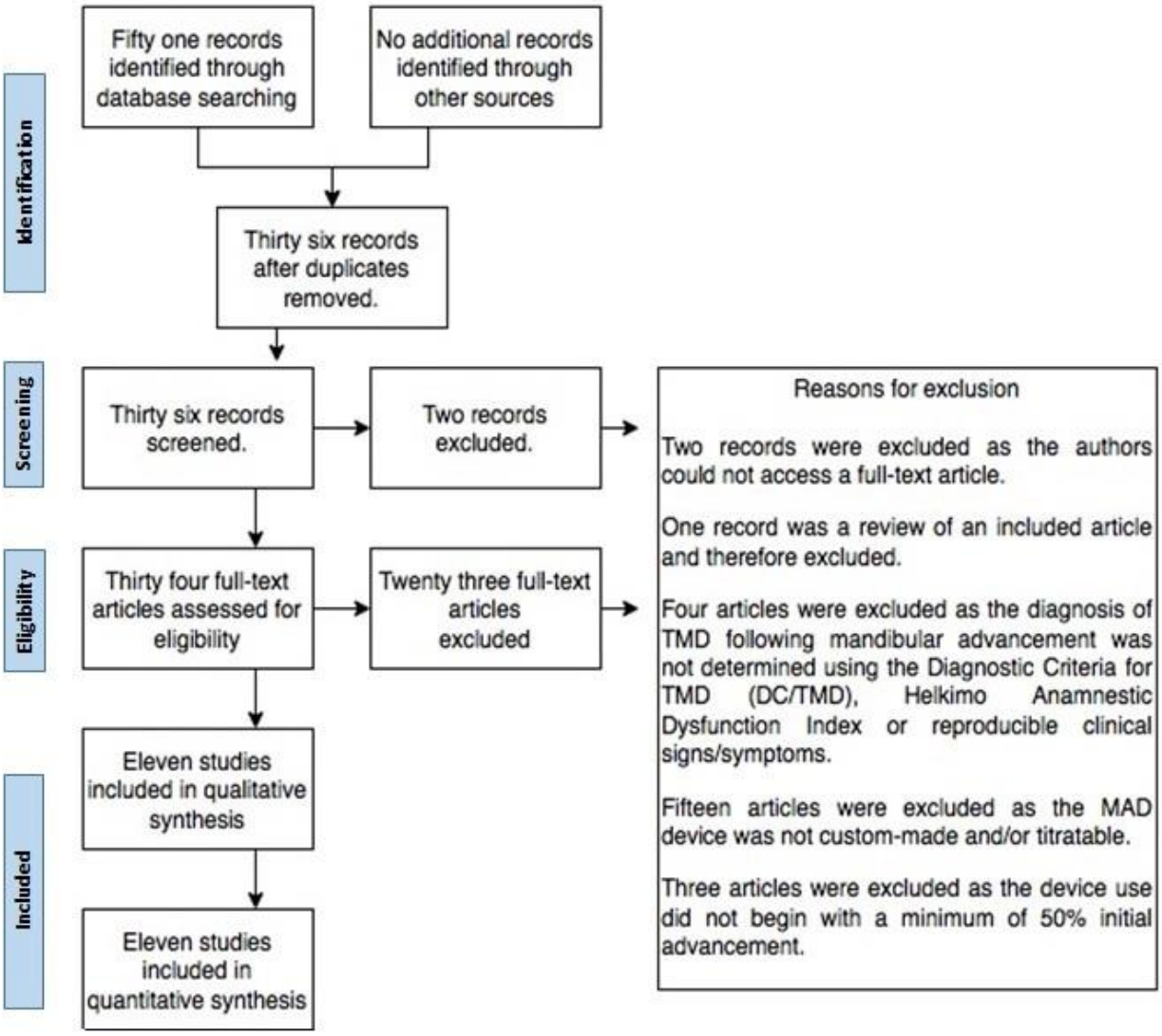

Fig. 1. Flow of information through the different phases of the systematic review.

3. Results

The studies found suitable were reviewed and the following results are collated and tabulated (Table 1, Table 2, and Table 3).

Table 1 Prevalence of TMD (Initial and Final) Across the Studies

Study	Total number of patients	TMD Prevalence (Initial)	TMD Prevalence (Final)	Time Period	Diagnostic Criteria /Signs and Symptoms to reach diagnosis
Almeida et al., 2002	7	14%	14% 1 patient developed with articular pain of right TMJ.	1.5 months (40 days)	Polysomnographic recordings were performed. A dentist performed the dental evaluation of the inclusion and exclusion criteria for MAD use. Patients were eligible only if they had no symptoms related to TMD and had a body mass index (BMI) less than 33 kg/m2. To investigate the anatomy and position of the condyle and disc of the TMJ, MRI of 7 patients was obtained before insertion of the appliance and after OA titration.
Bondemark and Lindman, 2000	32	0%	0% 37% of patients reported jaw joint pain and 30% of patients reported jaw muscle pain.	24 months	Patients answered questions based on the Helkimo anamnestic index, as well as questions regarding headache frequency. Clinical exam assessed the range of movement of the mandible, the function of the TMJ, pain on movement of the mandible, and pain on palpation of the TMJ and the masticatory muscles. Study casts were also taken before and after the 2 years of MAD therapy.
Clark et al., 2000	53	37%	Up to 40% of responding patients, reported jaw/facial muscle pain and/or jaw joint.	12 to 36 months	A telephone and mail survey was done at least 1 full year after device therapy, and patients were asked to indicate what discomforts and the frequency with which they experienced it.
Cunali et al., 2009	87	52%	NR	NR	Axis I (RDC/TMD): Clinical Physical Examination was used to diagnose TMD. Axis II (RDC/TMD): Biobehavioral Questionnaires, from the

					Scoring Protocol for Graded Chronic Pain index, were used to classify pain according to its intensity and the pursuant limitation. All patients completed the Axis II: Biobehavioral Questionnaires. A clinical examination used for confirmation and classification of TMD was carried out according to the Axis I: Clinical Physical Examination Forms and specifications of the RDC/TMD.
Fritsch et al., 2001	22	36.3%	0%	12-30 months	All of the 22 patients reported minor side effects. 9 reported jaw pain and 8 reported stiffness or pain of masticatory muscles. After 12 to 30 months of MAD therapy, symptoms and side effects were evaluated using a questionnaire. A clinical dental examination, a lateral cephalography, wax bites, and plaster models were carried out.
Giannasi et al., 2009	42	5.8%	0% 2 patients reported TMJ discomfort lasting for the first 6 months. 3 patients reported that the TMJ noises had disappeared and 3 patients exhibited decreased frequency in TMJ noises.	36+/- 17 months	Patients responded to a questionnaire based on the Helkimo Anamnestic Dysfunction Index. Patients were contacted by telephone interview to answer the same questionnaires after 36.0± 17.0 months.
Hammond et al., 2007	64	44%	NR	NR	The patients' subjective assessment of their TMJ status revealed that 20 patients experienced mild symptoms and 2 patients experienced severe symptoms. Patients

					responded to a questionnaire based on the Helkimo Anamnestic Dysfunction Index. This was followed by a clinical evaluation of mandibular and TMJ functions.
Martinez-Gomez et al., 2010	40	26%	27% prevalence at 14 months. 7% prevalence at 58 months. One of the 5 patients initially diagnosed as disc displacement with reduction. 2 patients were diagnosed as disc displacement without reduction and 5 diagnosed as muscle pain or arthralgia stopped using the MAD because it was ineffective.	4.8 years (range, 3.6 to 5.8 years)	Before treatment was initiated, one dental clinician examined all patients, applied the RDC/TMD protocol, and recorded the occlusal characteristics. A questionnaire was used to record the side effects reported by the patients. At baseline, 10 patients were diagnosed with TMD. Of these, three were classified with muscle pain (group I), 7 classified with disc displacement with reduction (group II), and 2 classified with arthralgia (group III). During advancement of MAD, 4 patients reported mandibular pain. 3 of these cases were diagnosed as arthralgia and the other as muscle pain. 2 of these four patients had not been diagnosed with TMD at baseline.
Napankangas et al., 2012	15	20%	NR	NR	Patients reported any subjective symptoms they experienced, such as pain in the TMJ, difficulty in mouth opening, TMJ clicking/crepitation, and TMJ locking/luxation. The clinical stomatognathic examination included measurement of the ranges of mandibular movements, evaluation of deviation of the mandible, evaluation of TMJ and TMJ sounds.
Pantin et al., 1999	132	26.5%	6%	5 years	35 patients reported temporomandibular joint pain and 33 patients reported muscle pain.

					Each patient answered a questionnaire about the occurrence of side effects. A clinical examination assessed the TMJ and occlusal relationships. Examination of the temporomandibular joints revealed noises in 9 of the 106 patients (8%) who did not have joint noises prior to treatment.
Perez et al., 2013	167	19.8%	11.2%	413 days (13.5 months)	Patients were evaluated through clinical examinations and questionnaires, and TMD was assessed using the RDC/TMD criteria. The prevalence of TMD was 33/167 (19.8 %) at baseline. After an initial decrease to 14.5 % after 118 days (visit II), the prevalence increased to 19.4 % after 208 days (visit III) and finally demonstrated a decrease to 8.2 % after 413 days (visit IV). The incidence of TMD was 10.6 % after 118 days. This decreased on further visits and only 2 (1.9 %) patients developed TMD from visit III to visit IV.

Legend: NR, not reported

There was substantial range in the prevalence of TMD signs and symptoms amongst studies included in this review. Across the eleven eligible studies, the average prevalence was found to be 25.6%, though some studies reported incidences as high as 52%, and as low as 0%. As the different studies had different review periods, the initial time period refers to the duration post commencement of treatment of OSA with MAD, till the recall period with the studies' authors. The final time period refers to when that individual study was concluded.

Table 2 Percentage of Patients Discontinuing Treatment

Studies	% Of patients discontinuing treatment	Additional Information
Almeida et al., 2002	14%	After 40 days, 1 of the 7 patients experienced persistent articular pain of the TMJ region, despite adjustments in the MAD. The patient was advised to discontinue MAD therapy and it resolved after 4 weeks. MRI showed that in the patient with articular pain, the condyle reached a more anterior compartment while wearing the MAD, when compared to maximum mouth opening.
Bondemark and Lindman, 2000	0%	None of the patients showed more than five symptoms of dysfunction either at the start of or after 2 years of treatment. It was concluded that 2 years' treatment with a MAD had no adverse effects on the craniomandibular status and function, but the observed occlusal changes requires further evaluation.
Fritsch et al., 2001	0%	Side effects were common but only mildly disturbing, and all patients wished to continue with MAD treatment. There was measurable change in position of the teeth and of occlusion of some patients. Severe discomfort or damage to the teeth or temporomandibular joints that would have led to discontinuation of therapy did not occur.
Clark et al., 2000	49%	49% of patients discontinued use of the device within 3 years. Of the 53 responding patients, 40% reported jaw/facial muscle pain, 40 percent had occlusal changes, 38% reported tooth pain, 30 percent reported jaw joint pain and 30% experienced xerostomia.
Giannisi et al., 2009	9.5%	The authors noted no impairment to the TMJ in patients with OSA presenting with mild TMD symptoms. Otological symptoms also reduced during the period of this study.
Martinez-Gomez et al, 2010	62.5%	In some patients, 5-year MAD use was associated with mild, temporary subjective side effects and permanent occlusal changes, mainly during the first 2 years. The use of the MADs did not affect TMD prevalence.
Marklund et al., 2004	24%	Discomfort, including excessive salivation or a feeling of awkwardness when wearing the MAD was the main cause of poor adherence. Insufficient effect on snoring, odontologic problems, periodontal disease and changes in occlusion during treatment were some of the other explanations for poor adherence.
Pantin et al., 1999	15%	7.5% ceased because of side effects, 6% stopped because of pain arising from the temporomandibular joint, facial muscles, or teeth, and 1.5% because of occlusal change.
Perez et al, 2013	49.1%	By 413 days, 49.1% of patients had dropped out. The reasons were not clear, however some patients reported the development and persistence of jaw joint pain as well as muscle pain.
Ringqvist et al., 2003	9%	4 patients withdrew because they were not comfortable with the MAD treatment.

The prevalence of TMD after the initial phase of treatment, as noted on follow-up appointment/s and the percentage of patients who discontinued treatment revealed that the prevalence of TMD decreased. Across the studies, the adherence to MAD appears to vary, however from analysis, it appears an average 20% of patients discontinue MAD therapy over six to 120 months, and this number has been reported to be as high as 62.5% (over 58 months).

Table 3 Limitations of the Studies

Paper	Limitations
Almeida et al., 2002	This study had a small sample size. Due to polysomnographic expenses and lack of patient adherence for many repeat sleep studies, the analysis of only seven patients was completed. Treatment adherence could not be objectively verified.
Bondemark and Lindman, 2000	Poor reliability of the answers concerning subjective symptoms in the questionnaire. Patients reporting less than 5 symptoms were classified as having no TMD. Treatment adherence could not be objectively verified.
Clark et al., 2000	A more aggressive post-insertion recall program might have substantially increased the adherence to treatment. A majority of patients elected not to follow the authors' advice and participate in a second, post-appliance sleep study. Treatment adherence could not be objectively verified.
Cunali et al., 2009	The sample size had a higher number of females than males, and their mean age was relatively young (47 years old). One dentist performed the diagnosis of TMD; independent confirmation of TMD diagnosis by two dentists is desirable. There is a lack of a control sample population matched for age and gender without OSA. Treatment adherence could not be objectively verified.
Fritsch et al., 2001	Treatment adherence could not be objectively verified. Two different devices were used: the Monobloc and the Herbst.
Giannasi et al., 2009	Treatment adherence could not be objectively verified. Patients reported wearing the appliance at least 4 nights a week.
Hammond et al., 2007	There was a lack of a standardized pre-treatment TMJ assessment. The small number of patients undergoing sleep studies and the different methods of polysomnographic recordings limited the evaluation of the changes in polysomnographic variables. Treatment adherence could not be objectively verified.
Marklund et al., 2004	The limitations of this study include selection of patients toward those with mild disease, having patients who were no more than slightly over-weight, and having the authors' own patients serve as their own controls in the study. There was no full polysomnographic sleep recordings including EEG, but instead the authors estimated sleep time from the respiratory sleep recordings and body position sensors. Treatment adherence could not be objectively verified.
Martinez-Gomez et al., 2010	There was no control group. It was difficult to know whether some of the adverse effects were related to the use of an oral appliance. Treatment adherence could not be objectively verified.
Napankangas et al.,	The limitations of this study are the small study sample and the lack of a control

2012	group. Treatment adherence could not be objectively verified.
Pantin et al., 1999	There was failure to obtain follow-up information in 59 of the patients, and the authors hypothesized that it is likely that they experienced side effects similar to those studied. Treatment adherence could not be objectively verified.
Perez et al., 2013	Treatment adherence could not be objectively verified. The authors were not able to determine reasons discontinued treatment. Follow-up polysomnographic data to confirm the end-point of titration were not available for most patients. Associated cost and lack of referring physician request prohibited this procedure. This information would have been ideal to objectively assess the adequate end-point of titration and overall success of MAD treatment.
Ringqvist et al., 2003	A limitation of the study was that these results could only be applied to adult male patients with mild-to-moderate OSA using an appliance with 50% advancement of the mandible and a small vertical opening (3 mm, on average, between the incisal edges).

4. Discussion

From our results of the studies evaluated, we concluded that MAD therapy for OSA appeared to be linked with TMD in a small and variable number of patients. It has been postulated that symptoms of TMD in patients undergoing MAD therapy were equivalent to that of a general population; however this review found the average TMD prevalence across the eleven studies was 25% of OSA patients (Hammond et al., 2007). TMD can affect 4% to 9% of the middle-aged general population (Cunali et al., 2009). It was also found that there was substantial diversity in the outcome measures used among eligible trials. Cunali et al in 2009 found a TMD prevalence of 52% in their patients, the largest percentage across the studies evaluated. However, out of the 45 TMD patients, 13 were excluded: two due to diagnoses of other diseases, and 11 due to the fact that they did not return for a clinical exam. Of further interest, the authors suspected that eight patients did not fully comply with the treatment.

Bondemark in 1999 reported no significant TMD in their patients and concluded that two years' of treatment with a MAD had no adverse effects on the craniomandibular status and function. A small number of patients had tenderness to palpation of the masticatory muscles, most commonly the temporalis muscle; without reported TMJ locking or subluxation. The TMJ function showed minor differences before and after two years of treatment. TMJ sounds were found in nine patients before treatment and in twelve patients after the two-year treatment. It is evident that some changes had occurred among the patients during the two-year treatment period. While none of the patients had more than five symptoms, either at the start of treatment or after two years of treatment with the MAD, it is reasonable to conclude that TMD in their patients was likely present in a small number if evaluated using a different diagnostic criteria such as the DC/TMD.

Across the studies, TMD appears to be more common during the initial period of therapy, and its severity and duration varies widely. This is possibly due to different study designs. However, most studies reported that these adverse symptoms that appear in the initial phase of treatment are transient in a large number of affected patients, and there appears to be a trend of symptoms to decrease over time in the majority of patients. One study reported an improvement in TMD signs

and symptoms in some patients undergoing MAD therapy for OSA (Giannasi et al., 2009). In another study, the prevalence of orofacial pain increased with the use of MAD; however this study was based on a single question broad questionnaire and hence the results should be interpreted with caution (Vuorjoki-Ranta, 2014).

The most common TMD diagnosis was reported to be masticatory muscle pain with or without limited mouth opening, the most common subjective TMD symptom was TMJ clicking and/or crepitation and the most common clinical TMD sign was masticatory muscle pain, on palpation and function (Napankangas et al., 2012). Another study observed that low disability grade I (low disability and low-intensity pain) was the more frequent classification (Cunali et al., 2009). The studies used different criteria for assessment of TMD including some that use signs and symptoms to designate the diagnosis TMD. Hence it is difficult to subcategorize the TMD diagnosis into masticatory muscle pain, internal derangement, arthralgia or a combination of these diagnoses.

Despite the side effects of MAD therapy, some patients reporting symptoms related to TMD continued using a MAD (McGown et al., 2001). Other studies reported that patients with existing TMJ crepitation discontinue their MAD therapy more often than patients without this finding (Napankangas et al., 2012) Across the studies, the adherence to MAD appears to be variable. There also appears to be a declining trend of adherence over time (Cistullo et al., 2004). The adherence rate of MAD after one year ranged from 55% to 82% (Cistulli et al., 2004). From our results, it appears an average of 20% of patients discontinue MAD therapy over six to one hundred months, and this number has been reported to be as high as 62.5% (over fifty eight months) (Martinez-Gomis et al., 2010). Reasons given included the aforementioned side effects, social circumstances, as well as lack of perceived efficacy (Martinez-Gomis et al., 2010). Treatment for TMD should be considered, in particular for patients with pre-existing TMD symptoms, as treatment could prevent or reduce pain associated with TMD (Cunali et al., 2009)

A study compared TMD rates in patients with OSA being treated with MAD and CPAP (Doff et al., 2010). They noted that in the initial phase of treatment, TMD rates in patients using a MAD were 24% higher than those using CPAP, and reported that while MAD therapy was associated in a short-time follow-up with more pain-related signs and symptoms of TMD and increased TMJ pain compared with CPAP therapy, after one and two years a decrease of TMD was observed (Doff et al., 2010). The risk of developing pain and function impairment of the temporomandibular complex appear limited with long-term oral appliance use, and there were no limitations in mandibular function in both groups during the follow-up period (Doff et al., 2010) Because of the transient nature, the authors concluded that this pain is not a contraindication of oral appliance therapy in OSA patients (Doff et al., 2010). Although MAD and CPAP have been considered as alternative treatment pathways, there may be some scope for a patient to alternate between them as needed. There have been recent suggestions of combining the two treatment modalities simultaneously for additional benefit; the effect of MADs in opening the upper airway may reduce CPAP pressure, which may be desirable as high pressure requirement can lead to intolerance and reduced adherence in some patients (Vuorjoki Ranta, 2014).

There was difficulty in comparing the studies due to the differences in follow up time, methodology, sample size and diagnostic criteria. Some studies included patients with a previous history of TMD while some excluded them. The degree of initial mandibular advancement was set at different

percentages of maximum protrusion. The findings also suggest that standardized criteria for TMD diagnosis, such as the DC/TMD, should be part of the examination procedure and the use of such criteria to diagnose and establish the impact of TMD is imperative. This lack of criteria used in previous studies might explain why TMD is understated or overstated by both dentists and patients (Cunali et al., 2009) Independent confirmation of TMD diagnosis by two or more practitioners should be considered, as would comparison of the prevalence of TMD in a control sample population matched for age and gender without OSA. Longer clinical follow-up studies, with an objective method of monitoring patient adherence such as home monitoring devices, and preferably with a larger sample size are needed to evaluate the long-term effects of MADs on TMD.

5. Conclusion

The authors consider it prudent for clinicians to counsel patients that a small number will experience signs and symptoms of TMD with MAD use. However TMD is usually transient and the long-term risk appears small. Patients with pre-existing TMD should be treated prior to commencing MAD therapy. In patients who develop TMD during MAD therapy, treatment of their TMD is recommended to prevent discontinuation of MAD therapy. In a few patients, persistent TMD may result in discontinuation of MAD therapy. Patients should be cautioned of this possibility and subsequently referred to consider other treatment options for their OSA.

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Conflict of Interest

None

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