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Original Article

Predictors of long-term effectiveness to mandibular repositioning device treatment in obstructive sleep apnea patients after 1000 days

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ABSTRACT

Objective/background: In obstructive sleep apnea (OSA), long-term adherence to treatment is crucial. This prospective single-center study investigated factors associated with long-term adherence to mandibular repositioning device (MRD) therapy.

Patients/methods: All OSA patients who had MRD treatment initiated in the previous year were prospectively contacted to evaluate long-term effectiveness and compliance. Long-term adherence was based on continuation of treatment (yes/no). Predictors of long-term adherence were analyzed using an adjusted multivariate analysis.

Results: Median follow-up was 1002 days (interquartile range: 668–1345) in 279 patients (age 58 [50–64] years); 63% of patients were continuing MRD treatment with a good efficacy, tolerability and compliance over time. In some patients, relapse of nocturia was observed while efficacy was maintained for snoring and somnolence. In adjusted multivariate analysis, significant predictors of continuing MRD treatment were early ≥50% reduction in AHI (odds ratio [OR] 2.73, 95% confidence interval [CI] 1.466–5.10; p = 0.0002) and complete symptom resolution (OR 3.83, 95% CI 1.74–8.48; p = 0.0014). In the 37% of patients who stopped MRD treatment, median treatment duration was 351 (174–752) days. The main reasons for late stopping of treatment were inefficacy (26.2%), discomfort (25.2%) and side effects (21.4%).

Conclusions: After three years, MRD was effective for the two-thirds of OSA patients who continued treatment. Relapse of nocturia might be an early signal of MRD wear that may explain long-term cessation of treatment in some patients. Short-term control of OSA by MAD was predictive of long-term efficiency. The major criteria were a ≥50% reduction in AHI and complete symptom resolution at short-term evaluation.

1. Introduction

Obstructive sleep apnea (OSA) is characterized by recurrent collapse of the upper airway during sleep. Obstructive apneas and hypopneas lead to oxygen desaturation, sleep fragmentation and increased sympathetic tone, which in turn induce a variety of systemic consequences [1]. OSA has been associated with cardiovascular morbidity [2], sleepiness-related accidents [3] and cognitive

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dysfunction, particularly in memory, attention and executive function [4]. The rate of cardiovascular events can be significantly reduced by treatment with continuous positive airway pressure (CPAP), which is considered the standard of care. However, more than 40% of patients do not tolerate CPAP or use it irregularly [5].

Mandibular repositioning devices (MRDs) protrude the mandible and tongue, and enlarge and stabilize the upper airways during sleep [6]. Over the short term, MRDs are less efficient than CPAP at reducing respiratory events, but are associated with better long-term compliance and similar efficacy on symptoms and quality of life (QOL) [7], making MRDs a viable alternative to CPAP for the treatment of OSA [8,9]. Two long-term studies, both based on observational follow-up of initially randomized trials, compared MRD to CPAP and reported smaller reductions in the apnea-hypopnea index (AHI) but similar effects on symptoms compared with CPAP, akin to findings over the shorter term [10,11]. Possible side effects of long-term MRD use include dental adverse events, such as occlusal changes [12], which may lead to poor compliance [12–14]. Practical considerations may also limit long-term compliance. In fact, there is a lack of data on the long-term clinical effects of MRDs, and particularly on long-term compliance with therapy. The main objective of this study was to provide long-term data on MRD use in a large cohort of OSA patients treated in routine clinical practice, and to evaluate if some factors could help physicians predict long-term adherence.

2. Methods

This observational, single-center study was conducted at the Pitié-Salpêtrière Hospital, France, was in accordance with Declaration of Helsinki principles, and consisted of a long-term evaluation of MRD effects based on one prospective contact. In addition, baseline data, titration process and short-term evaluation of MRD were extracted from patient's medical records at the time of the study. The Pitié-Salpêtrière Hospital is a large (n = 2146 beds) clinical and university center where OSA management is based on integrated care. Around 400 OSA patients per year are newly diagnosed (on 700 polysomnographies for OSA suspicion) and treated by either CPAP or MRD. The majority of patients that are treated by CPAP and MRD treatment represent around 15–20% of treatment indications. In this study, a dedicated dental specialist managed MRD treatment of OSA patients and worked closely with sleep specialists; MRD treatment and collection of data about efficacy, tolerability and compliance were procedure-based. Ethics Committee approval and data processing authorization were obtained for the study (CCTIRS, Comité Consultatif sur le Traitement de l'Information en matière de Recherche dans le domaine de la Santé; CNIL, Commission Nationale de l'Informatique et des Libertés). All patients were provided with information about the study and were free to refuse participation.

2.1. Patients and eligibility to MRD treatment

Eligibility for MRD treatment in this study was based on the sleep specialist's evaluation (clinical evaluation and polysomnography) followed by the dental specialist's evaluation (clinical evaluation and panoramic X-ray). All OSA patients referred to the dental specialist by the sleep specialist with an indication for an MRD were screened. All patients having been treated by MRD for at least one day and who had started treatment at least one year previously (those who were still using the device at the time of the prospective contact for our study and patients who had stopped treatment in the period between initiation and our prospective contact) and consented to take part in the study were included in the analysis. Patients who did not initiate the MRD treatment were screened but not included. Indication of MRD treatment, was based on French indications in OSA (patients with an AHI >30/h or ≤30/h with severe excessive sleepiness in patients intolerant to or refusing CPAP; OR 5/h ≤ AHI ≤ 30/h, mild to moderate excessive sleepiness and without severe cardiovascular morbidity). The dental specialist confirmed or disconfirmed the indication of MRD. He performed an in-depth clinical evaluation (number of teeth, dental mobility, periodontal and temporomandibular evaluations) and a radiological evaluation based on a panoramic X-ray to detect any other dental or periodontal diseases. For all patients, measurements of mandibular advancement from end to end in maximum protrusion, maximal jaw propulsion, dental overjet and dental overbite, were completed. Contraindications were less than eight healthy teeth per jaw, periodontal disease, and temporomandibular joint disease. A cephalometric evaluation was not required even if some patients had this evaluation (not collected in this study).

2.2. Data file collection for baseline data, titration process and short-term evaluation

Baseline variables, MRD-related data (treatment initiation date, type of MRD and titration), short-term clinical and AHI evaluation, tolerability and compliance data were obtained from patient medical records. For PSG data, American Academy of Sleep Medicine (AASM) guidelines [15] were used to define respiratory events. Apnea was defined as absence of airflow for at least 10 s, hypopnea as a reduction of airflow by at least 30% associated with a decrease in oxygen saturation of three percent or more, or with arousal.

2.3. Prospective long-term follow-up

Prospective long-term follow-up consisted of phone contact to obtain record of MRD effects. The first question determined whether the MRD was still being used or not. In patients who stopped MRD treatment, the cessation date, main reasons for MRD discontinuation and therapeutic changes were recorded. In patients continuing MRD treatment, global clinical efficacy (answer yes/no to the following question: “Is your device efficient on OSA symptoms?”), OSA symptoms, the Epworth Sleepiness Scale (ESS) score, MRD-related side effects, MRD-related compliance (use time per night, number of nights/week with use and reasons for low use) and patient satisfaction with MRD therapy were assessed. Satisfaction over the preceding four weeks of treatment was determined based on three general items (global satisfaction, quality of sleep, treatment manageable) scored on a scale from zero (very bad) to ten (excellent) and four items compared with CPAP (comfort, reduction in symptoms, compliance, social life) scored on a scale from zero (MRD worse than CPAP) to ten (MRD very superior to CPAP).

2.4. Statistical analysis

Measures are presented as median and interquartile range for quantitative variables and number and percentage for qualitative variables. Comparison between patients with vs. without continuation of treatment was performed as follows: group description was performed using mean ± standard deviation (SD) for quantitative variables and percentages for qualitative variables. Univariate comparisons were performed using Student's t tests for quantitative variables and Chi-square tests for qualitative variables. Two logistic models were created to determine predictors of treatment continuation, the first including the whole study population and the second including only patients with a short-term PSG evaluation. Variables with a p-value lower than 0.10 in the univariate analysis were entered in the stepwise logistic regressions, and