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Original Article

Long-Term Occlusal Consequences of Mandibular Advancement Devices in OSA: A Combined Prospective and 7-Year Retrospective Analysis

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ABSTRACT

The global occurrence of obstructive sleep apnea (OSA) highlights the demand for effective management strategies. Mandibular advancement devices (MADs) have proven to be a reliable intervention for mild to moderate OSA, despite their potential to cause dental changes. This research examined the characteristics, onset, and persistence of such dental alterations. In the prospective cohort (n = 12), dental impressions were recorded before MAD insertion and subsequently after three, six, nine, and twelve months to assess occlusal modifications. The retrospective cohort included individuals (n = 8) who had used MADs for an average of 7 years; their recent lateral cephalograms were compared with baseline radiographs. All participants completed a standardized questionnaire. Data were analyzed using t-tests, with statistical significance set at $p < 0.05$.

Most participants maintained consistent MAD use and noted substantial improvements in sleep quality, with minimal reports of jaw stiffness or discomfort. Significant reductions in overjet were identified across both cohorts: in the prospective group at six months ($p = 0.001$), nine months ($p > 0.001$), and twelve months ($p = 0.019$), and in the retrospective group between initial and seven-year follow-up measures ($p = 0.004$). A minor overbite increase of 0.2 mm was seen after one year in the prospective sample, while the long-term group showed a slight decrease ($p = 0.003$). No meaningful shifts were recorded in angle classification or lower incisor inclination. Cephalometric analysis revealed a notable change in the IOK-NL angle, from 98.2° pre-treatment to 95.2° following long-term therapy ($p = 0.020$). The findings indicate that MAD therapy effectively mitigates OSA symptoms while producing only minimal dental side effects. Moderate mandibular advancement appears optimal for balancing efficacy and oral health preservation. Nonetheless, the relatively small participant pool limits broader applicability of these outcomes.

Keywords: Mandibular advancement devices, Obstructive sleep apnea, Occlusal adaptation, Overbite, Overjet, Adverse effects

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Introduction

Sleep disturbances and their repercussions on general health have become a growing public concern. Epidemiological data suggest that roughly one-third of the world's population is affected by sleep-related disorders [1]. In 2014, the American Academy of Sleep Medicine (AASM) updated the International Classification of Sleep Disorders (ICSD), dividing it into six categories: insomnia disorders, sleep-related breathing disorders (SRBDs), central disorders of hypersomnolence, circadian rhythm disturbances, parasomnias, and movement-related sleep disorders. Among SRBDs, sleep apnea—manifesting as either central or obstructive—stands out as a key clinical issue. These episodes are characterized by repeated breathing interruptions during sleep lasting several seconds and are considered clinically relevant when lasting at least 10 seconds and occurring five or more times per sleep cycle [2].

Central sleep apnea (CSA) is relatively uncommon, representing under 20% of cases [3, 4]. Unlike the

obstructive form (OSA), CSA stems from disrupted neural respiratory control without airway blockage. OSA, which affects both adults and children, shows higher rates in men (4%) than women (2%), and recent analyses estimate approximately 936 million adults aged 30–69 have mild OSA, while 425 million experience moderate to severe forms worldwide [5, 6]. Overall, OSA prevalence is around 54%, with obesity, advancing age, and male sex serving as key risk indicators, though these factors do not fully explain interindividual variation [7].

OSA occurs more frequently in individuals with hypertension, coronary conditions, or those undergoing bariatric surgery. It negatively impacts daily functioning and has been linked to long-term complications such as cardiovascular disease and diabetes. Insufficient nightly sleep duration also contributes to excessive daytime fatigue [8]. The disorder arises from pharyngeal collapse during sleep, as relaxation of the pharyngeal and genioglossus muscles narrows the airway and restricts airflow [6, 9, 10]. Without intervention, OSA can precipitate persistent hypertension, cardiovascular events, or stroke, along with cognitive and social impairments [11].

An Apnea–Hypopnea Index (AHI) of 15 or higher per hour, combined with symptoms like snoring, sleepiness, and attention deficits, or comorbidities such as hypertension or atrial fibrillation, justifies treatment [12–14]. Management options span multiple disciplines and vary in invasiveness depending on disease severity and patient compliance. Non-invasive approaches include continuous positive airway pressure (CPAP) therapy and functional appliances like MADs, while surgical alternatives encompass nasal correction, pharyngoplasty, rapid maxillary expansion, bimaxillary osteotomy, and hypoglossal nerve stimulation [15–20]. CPAP remains the gold standard for moderate to severe OSA, offering excellent symptom control; however, adherence often declines—only about half of patients persist beyond one year—due to issues like device noise, oral or airway dryness, and facial pressure lesions [21, 22].

The second primary non-invasive therapy consists of mandibular advancement devices (MADs), which are individualized dual-arch splints created by dental professionals to reposition the mandible forward during sleep, effectively enlarging the upper airway [23]. These devices are composed of interlinked upper and lower plastic splints that maintain the mandible in a protruded position. The initial fabrication process involves dental impressions that register the jaw relationship at roughly 50% of the patient's maximum advancement, followed by the addition of adjustment elements that allow fine-tuning of the mandibular position by the clinician. Although continuous positive airway pressure (CPAP) remains the gold-standard intervention for OSA due to its efficiency in lowering the Apnea–Hypopnea Index (AHI) and improving oxygen levels, MADs are favored for mild to moderate obstructive sleep apnea syndrome (OSAS) and for individuals intolerant to CPAP. This preference stems from better patient comfort and adherence compared with CPAP [24, 25].

However, MAD therapy is associated with notable adverse effects, particularly those impacting dental occlusion. A decade-long investigation into sleep apnea management indicated that significant occlusal changes may develop over time, with MAD users showing greater alterations than those treated with CPAP [26]. Reported effects include lingual tipping of upper incisors, labial inclination of lower incisors, decreased overjet and overbite, and modifications in the total occlusal contact area—all of which may affect compliance and lead to discontinuation [27]. Further research is required to clarify the underlying factors that contribute to these occlusal alterations and to determine their long-term influence on patient outcomes.

Accordingly, this dual prospective and retrospective study was designed to systematically analyze both the frequency and extent of MAD-associated side effects, thereby improving the overall safety and acceptance of this therapy for OSA. The prospective component focused on determining when occlusal and alignment changes first appear, through follow-up assessments conducted at three-month intervals following device placement. Conversely, the retrospective analysis evaluated long-term tooth position modifications in patients with at least two years of MAD use. By addressing these elements, the study aimed to identify strategies to reduce unwanted dental effects while optimizing treatment success and overall patient care.

Materials and Methods

The investigation adhered to the ethical principles set forth in the World Medical Association's Declaration of Helsinki. Written informed consent was obtained from all participants. Ethical approval was granted by the University of Bonn Ethics Committee, Germany (reference number 322/22).

Patient groups

The prospective cohort included participants prescribed a MAD for OSA treatment. Inclusion criteria required regular device use and attendance at no fewer than three follow-up visits scheduled at three,

six, nine, and twelve months. Exclusion criteria encompassed withdrawal from participation, conversion to CPAP therapy, or loss of interest in the trial. Out of an initial pool of 28 subjects, 12 satisfied the inclusion requirements for final analysis. This group comprised four females and eight males with an average age of 59.7 years, mean height of 175 cm, and a BMI of 28.7, classifying them as overweight to mildly obese. Participants were monitored for 12 months while wearing MADs. Prior to therapy, all subjects underwent polysomnography, revealing a mean AHI of 19.6 events per hour (range: 5–37). For ethical reasons, cephalometric imaging was not performed in this group.

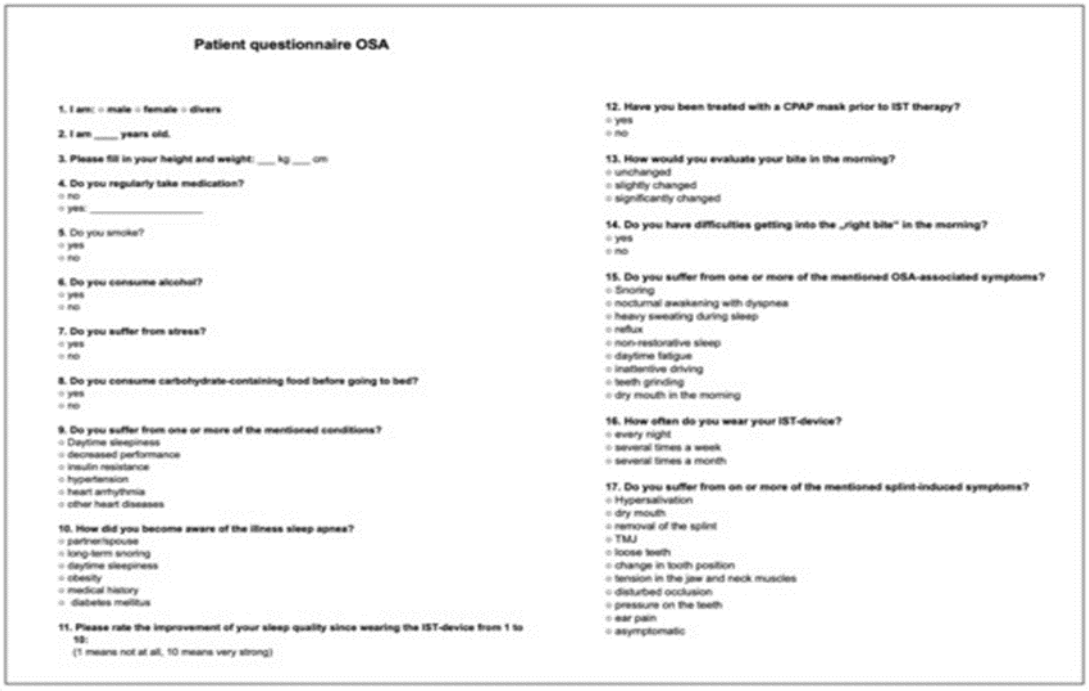
The retrospective cohort involved eight individuals who fulfilled the inclusion parameters of consistent MAD use, possession of pre-treatment lateral cephalograms, willingness to undergo repeat imaging, and device wear for at least two years. From an initial pool of 16, 31.2% were lost due to relocation or unavailability, while 18.8% declined further X-rays. This sample comprised one female and seven male participants with a mean age of 59.1 years, mean height of 181.9 cm, and average BMI of 27.2, classifying them as overweight. Their pre-treatment AHI averaged 34.6 events per hour (range: 17–68). The mean duration of MAD use at follow-up was 7 ± 5.1 years. A second lateral cephalogram was acquired to document skeletal and dental changes attributable to the therapy.

The treatment protocol involved mandibular advancement at 50% of the individual's maximum protrusive capacity, typically resulting in a head bite or minimal negative overjet, combined with vertical fixation between 6 and 8 mm.

Methodology of the prospective investigation

Participants in the prospective cohort were evaluated within the first year following MAD placement, with follow-ups scheduled at 3-, 6-, 9-, and 12-month intervals. The baseline assessment included both extraoral and intraoral examinations, accompanied by impressions of the upper and lower jaws. These impressions were repeated during every subsequent follow-up visit. To ensure measurement consistency, each set of models was analyzed twice per session. Parameters examined included angular measurements (SNA, SNB, ANB, NL-NSL, ML-NSL, ML-NL, IOK-NL, and IUK-ML) in addition to overjet and overbite.

At the 3-month follow-up, participants completed a custom-designed questionnaire based on two established clinical guidelines: the S3 guideline "Non-restorative Sleep/Sleep Disorders: Sleep-Related Breathing Disorders in Adults" and the S1 guideline "Mandibular Advancement Splint: Use in Dental Sleep Medicine for Adults" **(Figure 1)**. This guideline-based approach ensured methodological validity and provided comprehensive insights into patient experiences and treatment-related outcomes.



Patient questionnaire OSA

1. I am: ○ male ○ female ○ divers

2. I am ____ years old.

3. Please fill in your height and weight: ___ kg ___ cm

4. Do you regularly take medication?
○ no
○ yes: _____

5. Do you smoke?
○ yes
○ no

6. Do you consume alcohol?
○ yes
○ no

7. Do you suffer from stress?
○ yes
○ no

8. Do you consume carbohydrate-containing food before going to bed?
○ yes
○ no

9. Do you suffer from one or more of the mentioned conditions?
○ Daytime sleepiness
○ decreased performance
○ insulin resistance
○ hypertension
○ heart arrhythmia
○ other heart diseases

10. How did you become aware of the illness sleep apnea?
○ partner/spouse
○ long-term snoring
○ daytime sleepiness
○ obesity
○ medical history
○ diabetes mellitus

11. Please rate the improvement of your sleep quality since wearing the IST-device from 1 to 10:
(1 means not at all, 10 means very strong)

12. Have you been treated with a CPAP mask prior to IST therapy?
○ yes
○ no

13. How would you evaluate your bite in the morning?
○ unchanged
○ slightly changed
○ significantly changed

14. Do you have difficulties getting into the „right bite" in the morning?
○ yes
○ no

15. Do you suffer from one or more of the mentioned OSA-associated symptoms?
○ Snoring
○ nocturnal awakening with dyspnea
○ heavy sweating during sleep
○ reflux
○ non-restorative sleep
○ daytime fatigue
○ inattentive driving
○ teeth grinding
○ dry mouth in the morning

16. How often do you wear your IST-device?
○ every night
○ several times a week
○ several times a month

17. Do you suffer from on or more of the mentioned splint-induced symptoms?
○ Hypersalivation
○ dry mouth
○ removal of the splint
○ TMJ
○ loose teeth
○ change in tooth position
○ tension in the jaw and neck muscles
○ disturbed occlusion
○ pressure on the teeth
○ ear pain
○ asymptomatic

Figure 1. Patient questionnaire addressing OSA symptoms and MAD-related factors. The instrument comprised 14 items covering general medical background and issues related to both OSA and MAD use.

Screening intervals were designated as follows: T0 – Pre-treatment (before MAD insertion)

T1 – 3 months after insertion
T2 – 6 months
T3 – 9 months
T4 – 12 months

Methodology of the retrospective investigation

Subjects in the retrospective cohort attended a single visit (T1), during which they completed the patient questionnaire and underwent lateral cephalometric radiography. Parameters assessed from these radiographs included overjet, overbite, and dental angle class, calculated with the Z1 WinCeph and CellmatiQ software programs.

Previously recorded cephalograms from the pre-treatment period (T0) were compared with the newly acquired images to evaluate long-term morphological changes.

Statistical analyses

Data analysis was performed using Python 3.9.5, employing Pandas and NumPy for data management, Matplotlib and Seaborn for visualization, and SciPy for inferential statistics. The paired t-test and ANOVA were utilized to determine statistical significance of paired mean differences in the retrospective cohort. The level of significance was established at $p < 0.05$.

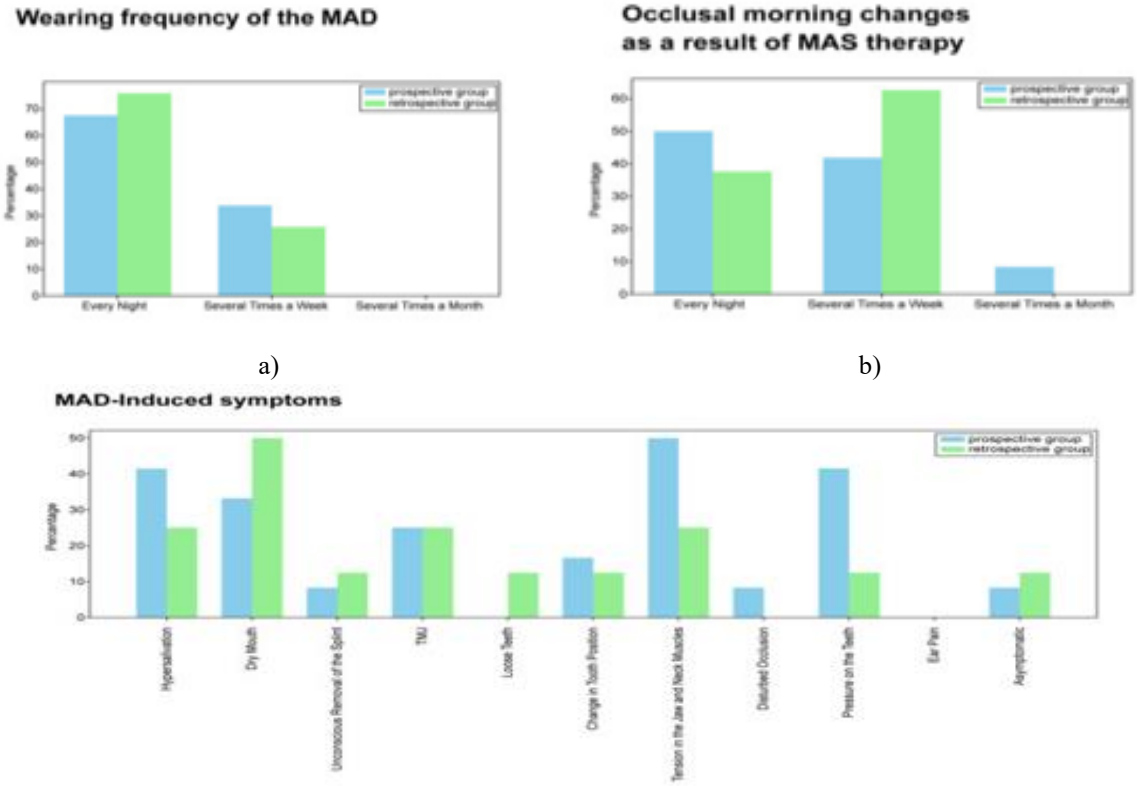
Results and Discussion

Questionnaire

Evaluation of questionnaire responses revealed high compliance with MAD usage. Approximately 70% of participants in both the prospective and retrospective groups reported nightly device wear, while the remainder used it several times per week; none reported less frequent use. Around 40% of the prospective sample and 60% of the retrospective sample experienced mild morning occlusal changes, whereas fewer than 10% of prospective participants described marked variations; the rest observed none.

Commonly mentioned device-related effects included excessive salivation, muscle tension in the jaw and neck, dental pressure, oral dryness, and temporomandibular joint discomfort (TMD), with the first three more frequently noted by the prospective group.

All respondents from both cohorts agreed that MAD therapy markedly enhanced their sleep quality. On a 1–10 improvement scale, the majority of the prospective participants rated it 9, closely followed by 7, whereas over 10% of retrospective users awarded a full score of 10.



a)

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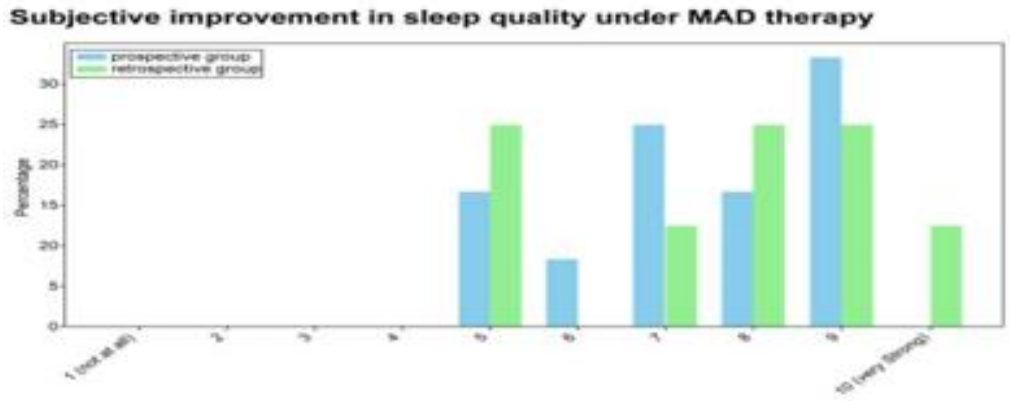


d)

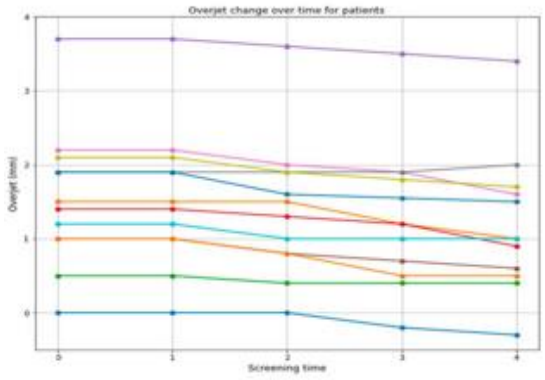
Figure 2. Key findings of the questionnaire. Summary of patient responses on MAD use frequency, perceived morning occlusal shifts, reported therapy-related symptoms, and subjective improvements in sleep quality.

Analysis of the models in the prospective group

Quantitative evaluation of the dental models demonstrated statistically significant shifts in both overjet and overbite across the study period.

For overjet, the hypothesis predicting measurable sequential reductions was largely supported. Between baseline (T0) and 3 months (T1), no significant change occurred. However, by 6 months (T2), a highly significant decrease was recorded relative to T1 ($p = 0.00066$). Further declines were observed at 9 months (T3; $p = 0.00337$) and at 12 months (T4; $p = 0.01947$). The mean initial overjet was 2.9 ± 1.4 mm, which decreased to 2.1 ± 1.1 mm by the end of the observation period.

Regarding overbite, the data indicated significant variations early in the treatment course. A deepening of the bite occurred between T0 and T1 ($p = 0.0261$), continuing at T2 after 6 months ($p = 0.0203$). Unlike the overjet, subsequent intervals (T3 and T4) showed no further statistically meaningful differences, indicating stabilization after 6 months. The average baseline overbite of 2.3 ± 1.7 mm slightly increased to 2.5 ± 0.3 mm by T4.



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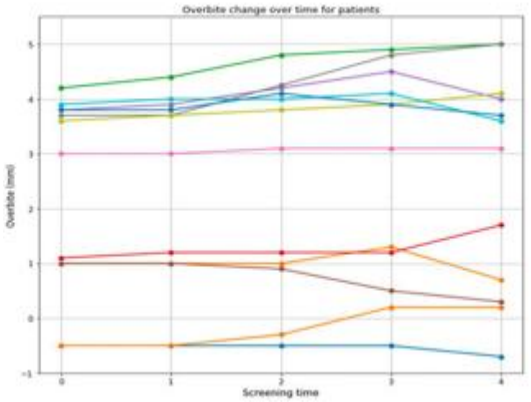


b)

Figure 3. Changes in overjet and overbite (mm) in the prospective group.
(a) Overjet and (b) overbite variations are shown across all time points: T0 (pre-therapy), T1 (3 months), T2 (6 months), T3 (9 months), and T4 (12 months). Each line represents data from an individual participant.

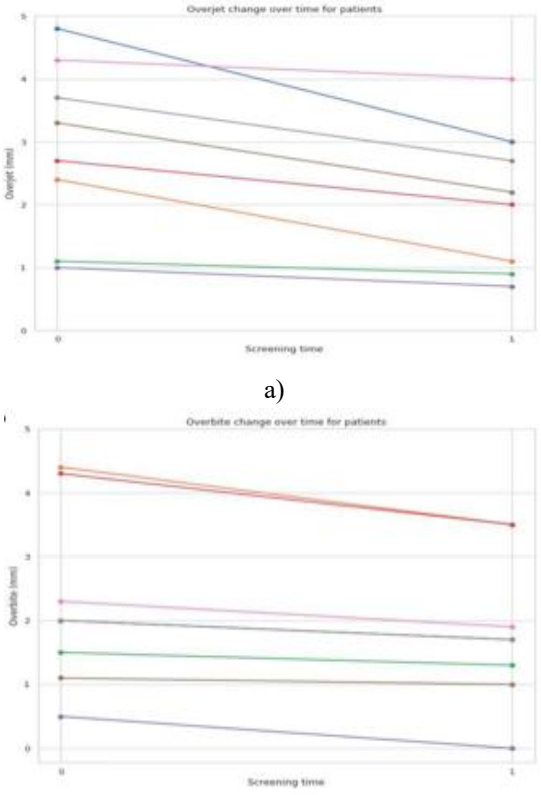
Further assessment of canine and molar angle classes on both sides revealed no statistically significant modifications throughout any of the observation intervals.

Evaluation of lateral cephalograms in the retrospective cohort

The evaluation of lateral cephalograms within the retrospective cohort offered valuable insight into the long-term dental effects of MAD therapy. Concerning expected changes in overjet from the initial measurement prior to treatment to the follow-up assessment—conducted after a minimum of two years of device use and an average of seven years overall—a marked reduction was recorded. This decrease in

overjet between baseline and follow-up ($p = 0.00409$) confirmed the findings seen in the prospective group, supporting the prolonged therapeutic influence of MAD use. Before MAD placement, overjet averaged 2.9 ± 2.1 mm, which diminished by more than half to 1.4 ± 1.1 mm after extended therapy.

Similarly, notable modifications in overbite between the two evaluation points were evident. At screening T1, a statistically significant p-value of 0.00323 compared with T0 highlighted a meaningful reduction, though in contrast to the prospective group, the trend revealed a smaller overbite decline. The mean overbite shifted from 2.3 ± 1.4 mm at T0 to 1.8 ± 1.2 mm at T1. **Figure 4** depicts individual patient data showing variations in both overjet and overbite measurements across evaluation times.



a)

b)

Figure 4. Overjet and overbite variations in the retrospective group analyzed from lateral cephalograms. Overjet (a) and overbite (b) in millimeters were recorded for each assessment. T0—initial visit before UPS treatment; T1—follow-up after a minimum of two years of therapy. Each color-coded line represents one patient.

Angle-based analysis of the lateral cephalograms further clarified MAD-induced changes over prolonged treatment. Among all angular parameters, only the IOK-NL angle, representing the axial inclination of the maxillary incisors relative to the maxilla, showed a statistically significant variation. The average decreased from 98.2° ± 8.1° at baseline to 95.2° ± 8.4° at follow-up ($p = 0.02017$), indicating a retroclination of the upper anterior teeth. All other angular metrics remained stable, suggesting a specific therapeutic influence on the IOK-NL angle within this group. **Figure 5** visualizes these angular shifts per patient.

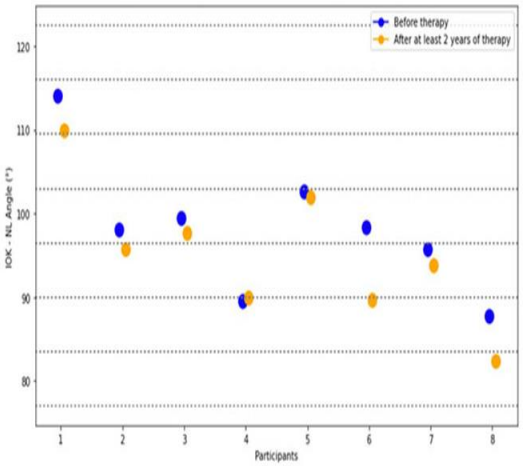


Figure 5. Alteration in IOK-NL angle within the retrospective group observed on lateral cephalograms. Blue dots represent pre-treatment values, and yellow dots correspond to post-long-term MAD therapy readings, expressed in degrees (°).

Mandibular advancement devices (MADs) are recognized as reliable treatment alternatives for mild to moderate OSA and for patients intolerant to CPAP, largely due to superior compliance and comfort. Despite this, they can induce occlusal side effects, such as retroclination of the upper incisors, proclination of the lower incisors, and variations in overjet and overbite, which may occasionally necessitate treatment discontinuation [27]. Although these effects are well-documented, there remains limited understanding regarding their onset, progression, and long-term evolution, as well as their association with compliance and sustained therapy use.

To address this issue, the present study incorporated both prospective and retrospective methodologies to thoroughly assess MAD performance, emphasizing usage habits, symptom relief, and occlusal modifications over time. Short-term evaluations in the prospective arm (every three months) helped identify the earliest appearance and development of side effects, while the retrospective cohort—comprising patients with long-standing device use—enabled analysis of prolonged outcomes. Questionnaire data

revealed strong patient tolerance in both groups, with most participants consistently using MADs overnight, leading to significant sleep improvement. Commonly reported effects included hypersalivation and TMJ discomfort, though these were typically tolerable. These observations align with other studies examining the persistent effects of MAD therapy, confirming its impact on occlusal patterns, facial musculature, and TMJ mechanics, yet emphasizing that such effects are generally manageable in light of substantial therapeutic benefits [28]. Furthermore, sustained adherence was supported by previous research noting continued device use even one month after treatment initiation, highlighting rapid patient adaptation to MAD therapy [29].

This study also demonstrated that MAD therapy produces noticeable modifications in overjet and overbite; however, the limited number of participants necessitates cautious interpretation, as the data may not adequately represent the broader population or reflect variations likely to appear in a larger sample. Among the prospective participants, a marked decline in overjet was seen after six months of therapy, with a steady decrease continuing through the twelve-month follow-up. Similar outcomes were confirmed in the retrospective cohort, evidencing a sustained long-term reduction in overjet. Cephalometric evaluation indicated a decrease in the IOK-NL angle, signifying retroclination of the upper front teeth, which may explain this effect since no changes in the occlusal class were detected in model analysis. Unlike the consistent overjet results across both groups, overbite measurements displayed differing trends. The prospective group initially showed a deepened bite after three months of use, which later stabilized, while the retrospective group exhibited a substantial long-term decrease in overbite. This temporary bite deepening may resemble the occlusal changes observed with aligner therapy [30]. During aligner use, intrusion effects commonly occur over time due to the aligner thickness and resulting occlusal forces—often termed the “bite block effect.” Nevertheless, this study revealed that such effects subside with extended use, while a reduction in overbite becomes evident as a biomechanical consequence of prolonged MAD therapy.

These observations, combined with the reduction in overjet and the retroclination of the upper incisors, correspond with earlier findings on MAD-related dental changes [27, 31, 32]. However, unlike those reports, no significant forward inclination of the lower incisors was detected here. This discrepancy may be due to variations in mandibular protrusion settings across studies, which range widely from 6% to 90% of the maximum possible advancement [33]. In the current study, a standard 50% of maximum mandibular protrusion was employed throughout treatment, in line with the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) guidelines, which recommend balancing therapeutic effect and patient comfort [26, 34, 35]. Other studies initiated treatment at 50% advancement and gradually increased to 85–100% of the full protrusion potential [34, 36]. Maintaining a constant 50% advancement in this study was intentional, reflecting DC/TMD recommendations and previously noted correlations between protrusion extent and upper incisor inclination [32]. The lack of measurable proclination of the lower incisors in both the prospective and retrospective cohorts might thus be linked to this moderate advancement, which, while conservative, was sufficient for effective OSA management. This assumption aligns with prior long-term research that applied the same 50% protrusion and found only minor, clinically irrelevant dentoskeletal alterations under MAD therapy [37]. Nevertheless, given the limited sample size, these findings should be viewed prudently, as broader population data might reveal additional variability or different outcomes.

This investigation also identified several constraints and clinical implications that warrant further attention. Primarily, the small cohort limits the representativeness and generalizability of results. Future studies should incorporate larger and more diverse populations to strengthen the applicability of findings. Additionally, the study’s dependence on patient-reported feedback for tolerability and side effects may introduce reporting bias, as perceptions of treatment success can influence symptom disclosure. Including objective clinical evaluations would enhance the reliability of outcome assessment. Moreover, while this research concentrated on select parameters such as overjet and overbite, it did not encompass all possible dentoskeletal or occlusal consequences relevant to MAD therapy, which are essential for a holistic understanding of treatment outcomes.

Although blinding was not applied in the measurement process, all recordings were performed by a single examiner, and the minimal variance in millimeter and submillimeter readings suggests that potential measurement bias was likely minimal.

From a statistical standpoint, ANOVA (Analysis of Variance) could have served as a viable alternative to the t-test used in this study, as it enables comparison of multiple group means simultaneously while reducing the likelihood of type I errors. Nonetheless, it was not implemented here because ANOVA requires a

sufficiently large sample size and assumes both normal data distribution and homogeneity of variances—conditions not met in this dataset. Therefore, the t-test was chosen as the more suitable analytical method, offering improved reliability and validity given the study's structure and sample limitations.

It is important to note that comparing retrospective and prospective outcomes requires careful interpretation, as each design carries inherent differences in data collection and potential bias. Additionally, the relatively small sample sizes in both groups reduce the statistical power of the analysis, thereby increasing susceptibility to type I and type II errors and limiting the broader applicability of the findings. Hence, the patterns observed here should be considered preliminary and warrant verification in larger, methodologically rigorous studies.

Clinically, the findings underscore the value of tailoring MAD therapy to the individual. The results suggest that maintaining a moderate mandibular advancement—approximately 50% of the maximum—may help balance treatment efficacy and minimize adverse effects. Practitioners should customize advancement settings based on patient comfort and response while ensuring continuous monitoring of dental and occlusal parameters throughout therapy. Regular checkups allow for early detection of side effects, enabling timely intervention and preventing discontinuation of treatment. Furthermore, these insights highlight the potential for refinements in MAD design, such as developing appliances that reduce anterior tooth pressure by excluding frontal components, thereby maintaining therapeutic efficiency while minimizing occlusal disturbances. Given the interdependence between dental health and sleep-related treatment, an interdisciplinary approach—integrating the expertise of dentists, orthodontists, and sleep specialists—may optimize outcomes by improving adherence and long-term management of OSA. Lastly, future studies should further explore the extended effects of MAD therapy on dental structures, patient compliance, and sleep parameters to inform more comprehensive treatment protocols and evidence-based clinical guidelines.

In summary, this research diverges from previous reports suggesting substantial MAD-related side effects, as the results here revealed only minor and clinically negligible alterations. MADs demonstrated strong therapeutic potential, markedly improving sleep quality and ensuring high adherence due to favorable patient perceptions of benefit. Although minor occlusal and general effects were observed—such as slight variations in overjet, overbite, and upper incisor inclination—they were minimal in clinical relevance. The absence of detectable changes in angle class or mandibular incisor inclination, contrary to existing literature, may stem from the consistent use of moderate mandibular advancement throughout treatment. Despite being modest, this degree of protrusion proved sufficient to effectively manage OSA, reinforcing the recommendation for a moderate advancement strategy. Nonetheless, these results should be approached with caution due to the small participant pool, which limits generalizability and may not capture the full variability in patient responses. Considering that most changes occurred in the anterior teeth, further investigations should focus on modifying appliance architecture to lessen pressure on these regions and prevent occlusal discrepancies.

Conclusion

In conclusion, this study affirms the therapeutic effectiveness of MADs in managing OSA, demonstrating minimal side effects despite anticipated changes in occlusion and dental alignment. The findings establish MADs as a powerful and well-tolerated treatment modality that substantially enhances sleep quality and patient adherence. While minor dental alterations were noted, they hold limited clinical significance compared to the considerable therapeutic benefits. This research diverges from earlier literature by maintaining a moderate mandibular advancement, which successfully minimized adverse dental outcomes while sustaining treatment efficacy. The lack of angle class modification or mandibular incisor protrusion highlights the importance of this moderate approach. Future research should focus on refining device design to reduce anterior pressure and further prevent occlusal deviations. Overall, these outcomes reinforce MAD therapy as a dependable and effective treatment for OSA, balancing clinical performance with the preservation of dental integrity.

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Conflict of Interest: None

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Ethics Statement: None

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