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CASE REPORT

Methods in Fabrication of Titratable Mandibular Advancement Appliance for Obstructive Sleep Apnea

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ABSTRACT:
Obstructive Sleep Apnea (OSA) is a condition that results due to partial or complete obstruction of airway when patient assumes a supine position as in sleep. Mandibular repositioning appliances (MRA) have been used since the last 3 decades and help in positioning the mandible forward to improve upper airway patency. In the present case report, we aim to show the stepwise construction and efficacy of a specific custom-made Medical Dental Sleep Appliance (MDSA) in terms of sleep apnea reduction.
Key words: Obstructive Sleep Apnea, sleep apnea reduction, Mandibular repositioning appliances.

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INTRODUCTION

Obstructive Sleep Apnea (OSA) is a condition that results due to partial or complete obstruction of airway when patient assumes a supine position as in sleep. Mandibular repositioning appliances (MRA) have been used since the last 3 decades and help in positioning the mandible forward to improve upper airway patency. An influential review in 1995 of Oral appliance therapy for OSA accompanied by practice parameters of American sleep disorder association signalled the entry of dentistry into main stream sleep medicine.[1] Adjustable mandibular advancement appliance became predominant form of dental therapy for sleep disordered breathing since 1990's.[2] Controlled studies in the last decade and a half have shown effectiveness and preference for oral appliances compared to continuous positive air pressure (CPAP) in mild and moderate cases[3-5]. Studies have also reported gross improvement in severe cases if patient selection is based on stringent inclusion criteria.[6] MRA have shown to significantly improve objective sleep measurements, such as AHI, arousal index, snoring and arterial oxygenation. They have been reported to improve quality of life, blood pressure and improvements in cardiovascular outcomes and inflammatory markers are similar to CPAP.[7]

There are several designs of adjustable mandibular advancement devices for OSA patients. There is no consensus on the design of adjustable MRA. Medical Dental Snoring appliance is an adjustable MRA and Class II intraoral dental device recommended for treatment of snoring and OSA.[8] It is readily available in India and one of the most cost effective. The aim of this article is to show the stepwise construction and efficacy of a specific custom-made Medical Dental Sleep Appliance (MDSA) in terms of sleep apnea reduction.

REVIEW OF LITERATURE

Young T et al (1993) in their study estimated that 4% of middle aged men and 2% of middle aged women in the western countries would meet the minimum criteria for sleep apnoea syndrome.[9]Udwadia ZF et al estimated the prevalence of sleep disordered breathing as 19.5% and of OSA as 7.5% in urban Indian males.[10] Oral appliances were introduced for management of OSA in 1980. Cartwright R reported that tongue retaining devices effectively reduce AHI[11]. Ferguson KA et al, Clark GT et al and Ferguson KA et al in separate controlled studies showed the effectiveness and greater patient preference for oral appliances as compared to CPAP in mild and moderate OSA.[3-5] Rose EC et al examined the initial effects of Thornton adjustable positioner (TAP), which is an adjustable mandibular advancement device, in patients with OSA and achieved predictable AHI based results[12]. Jayan B et al reported that oral appliance therapy for OSA is non-invasive, cost effective and beneficial to affected patients if desired efficacy is achieved. It greatly improves quality of life and cardio pulmonary health[7]. Johnston CD

et al concluded that mandibular advancement appliance was significantly more effective than the placebo in reducing the symptoms of OSA[13]. Ananterior titration of the mandibular position using OAs hasbeen reported to increase the anteroposterior diameter[14] andcross-sectional area[15] of the velopharynx, resulting in areduction of OSA severity.

Steps in fabrication of MDSA

Patients chosen for oral appliance therapy should be assessed based on stringent inclusion and exclusion criteria as given in Table 1. Thereafter the following steps are ensued.

1. Good orthodontic impression, which includes the complete vestibular depth, should be made preferably with elastomeric impression material.[Fig 1]
2. Working model poured with type IV or type V dental stone. [Fig 1]
3. Maximum Mandibular Protrusion Using George Bite Gauge and Bite Recordingis done.

The George bite gauge allows the clinician to capture the protrusive bite registration and vertical opening without relying on the patient to achieve proper positioning.

- To take a bite registration with the George Gauge: First place the George bite gauge in the patient's mouth without the bite fork attachment. Centre the lower incisor notch over the anterior teeth. Cinch up the lower incisor clamp to firmly grip these teeth, and tighten the lower turn screw to secure this position. [Fig 2]
- Remove the instrument from the mouth. Insert the bitefork, into the body of the gauge, and slide it until the indicator end is at the 0 point on the millimetre scale. Lightly tighten the upper turn screw.
- Return the instrument to the mouth with the lower incisor notch centred over the lower midline. Instruct the patient to close into the upper incisor notch with the midline indicator between the central incisors. Modify the upper notch with an acrylic bur if the incisors are rotated or if the incisal edges are excessively thick.
- While the patient is firmly biting into the notches instruct him/her to slide the jaw forward as far as possible. Note the + reading on the millimetre scale. Then ask the patient to move the jaw back as far as he/she can. Note the position on the - end of the millimetre scale. Add these two numbers without regard to the + and - signs. The total is the patient's protrusive range. Multiply that sum by 0.7 (70%), and add this number to the minus number (retrusive position). The result is the number at which you preset the George Gauge.[Fig 2]

Example: if the patient can protrude to the +6 mark on the millimetre scale, and can retrude to -4. Therefore, his protrusive range is 10mm. Take 70% of that range, which is 7mm, and add it to the most retruded position, which is -4. This gives you a setting of +3. Slide the marking end of the bite fork over the millimetre scale until its indicator end rests over the +3 mark, and tighten the upper turn screw.

4. Bite Recording
   - Full occlusal coverage is essential
   - Apply bite material directly onto the lower teeth going back to the most posterior tooth and apply bite material to the top of the bite fork that is attached to the George Gauge.
   - Return the gauge to the mouth with the lower incisor notch centred over the midline and allow patient to bite into upper groove.
   - Unscrew upper turnscrew and remove the bite fork.
   - Articulate the bite fork and impression with models. [Fig 3]
   - Keep the body of the George Gauge to use again in the future.
5. Adaptation of Durasoft Sheets of 2 mm thickness over both maxillary and mandibular models using vacuum forming machine using standard protocol. The adapted sheets are contoured to the gingival margins of all teeth both on buccal and lingual/ palatal sides. [Fig 3]
6. Fixation of MDSA: The upper and lower halves of the MDSA screw are positioned on the incisal area of the upper and lower durasoft trays respectively along the midline and stabilized with self cure acrylic.[Fig 4]
7. After ascertaining precise fit of the upper and lower halves of the appliance on the articulator and in patients mouth, the durasoft trays are reinforced with self cure acrylic.
8. The appliance is meticulously finished and polished making sure that there is no patient discomfort.[Fig 4]
9. Titration is done as and when required depending on subjective improvement.

Expected benefits

1. Snoring should show a major improvement from the first night. Patient cancan adjust the appliance with the key to further increase the benefit (one turn clock-wise advances the jaw by 0.25 mm).
2. Daytime sleepiness may take a little longer to improve as the body has a "sleep debt".

Side-effects

1) Salivation (dribbling) or a dry mouth is an initial reaction to having a foreign object in the mouth. This may persist for a few days, for some it may not occur.

2) Jaw discomfort is a common side effect with sleep appliances, but it is rarely a problem for people with no prior jaw symptoms. The discomfort is usually temporary and can be eased by heat application and / or jaw exercises or physical therapy. Patient can adjust the appliance with the key to reduce jaw tension, turning it anti-clock-wise.

3) Gagging tendency affects some people but it is usually transient.

4) Tooth or gum soreness may be caused by appliance pressure. This can be relieved by an adjustment in the clinic.

5) The bite will almost certainly feel different when the appliance is taken out in the morning. This may be caused

by temporary changes in the jaw muscles and joints during the night, it usually resolves within an hour.
6) Tooth movement has been observed occasionally with sleep appliances. Records of the teeth and bite are kept for long term review and changes are monitored.

Home care
1. Always clean the teeth before placing the appliance in the mouth.
2. Clean the appliance after removal in the morning with a soft tooth brush, antibacterial liquid soap or a non abrasive toothpaste and water. Do not use very hot water or bleach .
3. Store the appliance in a plastic box in a cool, dry place.

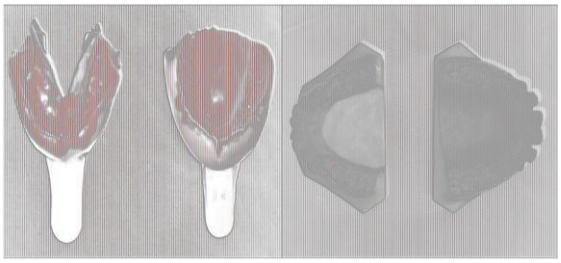

Fig 1: Impressions and Working models.

Fig 2: Bite recording with George bite gauge.

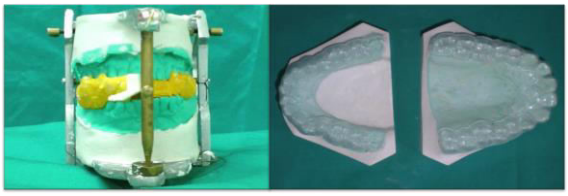

Fig 3: Articulation and Durasoft sheet adaptation on models.

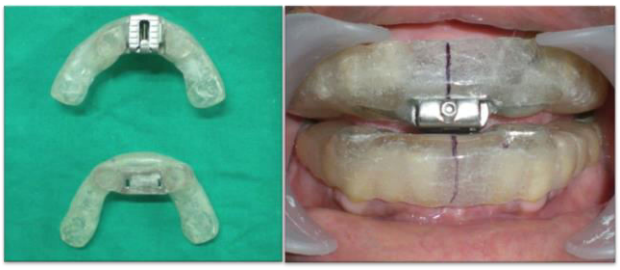

Fig 4: MDSA delivered to patient

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