

## Oral appliances treatment for obstructive sleep apnea

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### Abstract

Obstructive sleep apnea (OSA) is a physical disorder that leads to repetitive obstruction of upper air way, causing in 30 or more apneic (the pause of airflow at the mouth and nose for more than 10 seconds) episodes during sleep. It is caused by the repeated collapse or narrowing of the pharyngeal walls due to partial or complete obstruction of the upper airway. Treatment for sleep apnea include weight loss, keeping off alcohol, positional therapy, oral appliances, continuous positive airway pressure (CPAP). Oral appliances have proven to be useful, noninvasive and easy to use. Patients prefer oral appliances and mandibular advancement appliances to CPAP. Our study concluded that oral appliances may assist in the management of OSA.

**Keywords:** Obstructive sleep apnea, Appliance , Treatment

Obstructive sleep apnea (OSA) is a physical disorder that leads to repetitive obstruction of upper air way<sup>1</sup>, causing in 30 or more apneic (the pause of airflow at the mouth and nose for more than 10 seconds) episodes during sleep.<sup>2</sup> It is caused by the repeated collapse or narrowing of the pharyngeal walls due to partial or complete obstruction of the upper airway

The prevalence of OSA is fairly 3% for the middle-aged population<sup>2</sup> and in the adult working-age population of 4% for men especially overweight males and 2% for women who have an apnea-hypopnea Index greater than 5 per hour.<sup>4</sup>

OSA symptoms such as snoring, fatigue and sleepiness are usual. Snoring affects 35% to 40% of adults.<sup>5</sup> Dental devices might be used for treatment of snoring and OSA.<sup>7</sup> Another term that has been mentioned is obstructive sleep apnea hypopnea syndrome (OSAHS) that occurs as the base of the tongue contacts the posterior pharyngeal wall at intervals or partially occludes the upper airway when the patient is asleep.<sup>6</sup> Some patients have multifactorial etiologies interplay between the neuromuscular system, airway and anatomical structures.<sup>8</sup>

Dentofacial problems that are closely related to OSA include a narrow upper airway, hypoplastic maxilla, a retrognathic mandible, steep mandibular plane angle, narrow dental arches, increased lower anterior facial height, long soft palate and high palatal vault.<sup>9</sup> The head extends backwards to expand oropharynx at the tongue base and epiglottis. This head

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postures can compromise facial growth and occlusal development in children.<sup>10,11</sup>

### Treatment

Treatment for sleep apnea include weight loss, keeping off alcohol, positional therapy, oral appliances, continuous positive airway pressure (CPAP). Surgical methods such as uvulopalatopharyngoplasty (UPPP), maxilla-mandibular advancement surgery and tracheostomy.<sup>1</sup> Many of these treatments are limited by serious side effects and patient compliance. For instance, problems associated with CPAP use leading to noncompliance of patients, however, it is a very effective treatment. Only 50% to 80% of patients use CPAP for a long time.<sup>12,13</sup>

Oral appliances have proven to be useful, noninvasive and easy to use. Patients prefer oral appliances and mandibular advancement appliances to CPAP.

The appliance can be used only in compliant patients who are able to insert and remove it. Patients who are seriously mentally impaired cannot wear oral appliances easily because of involuntary mouth movements.<sup>3</sup>

The first effort to the use of dental device for sleep disordered breathing was by Pierre Robin. Robin described a one-piece device that he used in children with micrognathia and in snoring adults to manage severe upper airway obstruction.<sup>9</sup>

The major therapeutic intervention with oral appliances in the obstructed airway is to expand maxilla and/or advance the mandible. Mandibular advancement appliances are used in the dentofacial orthopedic treatment of people with hypoplastic and/or retrognathic mandibles. It results in apnea-hypopnea index (AHI) reduction. Furthermore, it can displace soft palate, suprahyoid muscles and the genioglossus anteriorly.<sup>14</sup>

Oral appliances (OAs) are mostly used in following indications:

- 1) Mild to moderate OSA severity
- 2) Low body mass index
- 3) Supine AHI
- 4) large mandibular advancement (ranges 8mm or more)<sup>15,16</sup>

TMJ dysfunction can be a relative contraindication to wearing OAs. women especially younger than 50 years are more successfully treated with OAs.<sup>17</sup>

A comparison between OA treatments versus UPPP showed significant effectiveness in reducing AHI by OAs. CPAP can reduce AHI much better than OAs. In measuring daytime sleepiness there was no considerable difference between all these ways.<sup>18</sup>

Three different types of OA are reported to improve snoring and/or OSA:

- a) A mandibular advancement device (MAD) (average mandibular protrusion was 3 to 5 mm and patients should wear it every night for average 8 months)
- b) A tongue retaining device (TRD) (to keep the tongue in a forward position to prevent posterior displacement into airway)
- c) Soft palate lift (SPL) (it reduces vibrations of soft tissue that result in snoring)

All three devices can be fascinating but the effectiveness of MAD is the most and SPL is the least.<sup>19</sup>

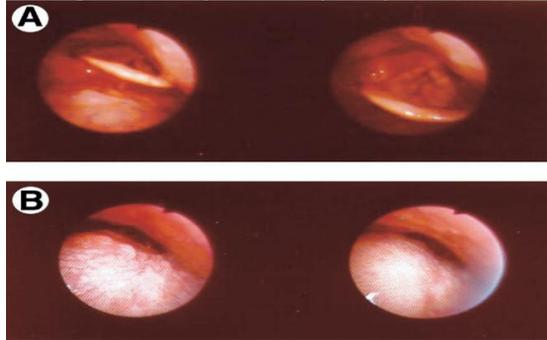
Cephalometric analyses after long term OA use showed some changes as following:

- 1) Increases in mandibular plane and ANB angles
- 2) Decreases in overbite and overjet<sup>20</sup>
- 3) Proclined mandibular incisors
- 4) Rretroclined maxillary incisors
- 5) Distally tipped maxillary molars
- 6) Mesially tipped and erupted mandibular molars
- 7) Increased lower facial height.

MAD can change position of the hyoid and increase the hypopharyngeal airway space.<sup>5</sup>

Because of many variations of OA it is difficult to predict what device will be most practical for a particular patient. Follow up

dental visits are essential (every 6 months during the first year and yearly thereafter)



**Figure 1**

With anterior mandibular repositioning, the patient's airway in (A) is open considerably more than that of the airway shown in (B). MRAs increase both lateral and antero-posterior dimensions of the upper airway at the hypopharyngeal, oropharyngeal, and velopharyngeal airway segments, and genioglossus neuromuscular activity activates during use of these appliances.<sup>17</sup>

### Side effects

Side effects of OA are common and acute in the initial phase of treatment:<sup>9,21</sup>

- 1) Brief pain of the upper and lower incisors after waking and myofacial pain
- 2) Extreme salivation
- 3) Mouth dryness
- 4) Gingival soreness
- 5) TMJ discomfort and worsening TMJ disease
- 6) Occlusal and orthodontic malalignment but they are transient and disappear with use. They include:
  - a) Overjet and overbite reduced (mean 1-3mm)
  - b) Retroclination of upper incisors (mean 1/90)
  - c) Proclination of lower incisors (mean 2/80)
- 7) Noises
- 8) Headaches and bruxism
- 9) Gagging

### Oral appliances

There is no special construction of oral appliances in patients and there are lots of varieties of them in use. They are made from hard or soft materials and can exist as one-piece or two-piece. Two-piece appliances have some oro-facial effects such as tongue protrusion, TMJ movement, mandibular advancement and lifting of the soft palate.<sup>9</sup>



**Figure 2**

One-piece or two-piece appliances are better than "boil & bite" thermoplastic splints. They are not suitable as a screening tool because they can protrude mandible about 5 to 7 mm and elevate it vertically about 10 to 15 mm.<sup>9</sup>



**Figure 3: Mandibular advancement appliance in partially edentulous patients**

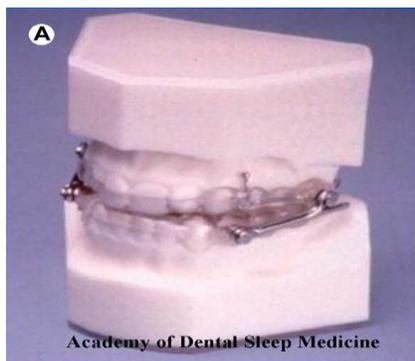


Figure 4:Herbst-like appliance<sup>6</sup>

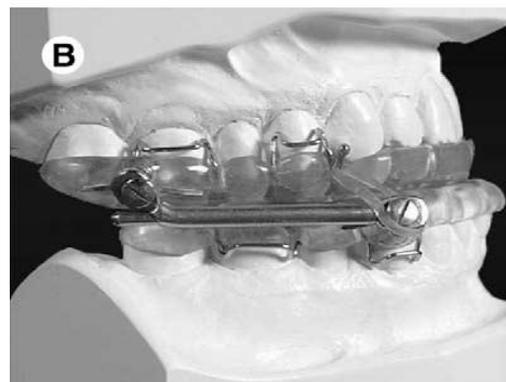


Figure 6:A)monobloc B)Herbst<sup>6</sup>

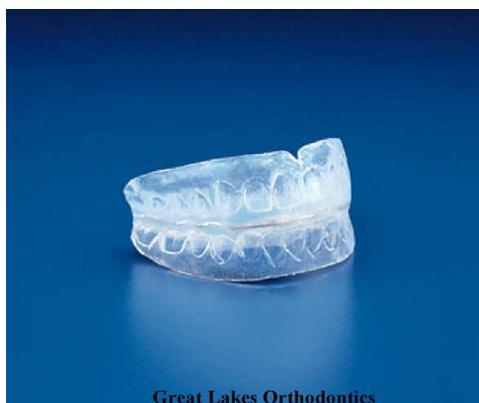


Figure 5: Silicone positioned appliance<sup>6</sup>

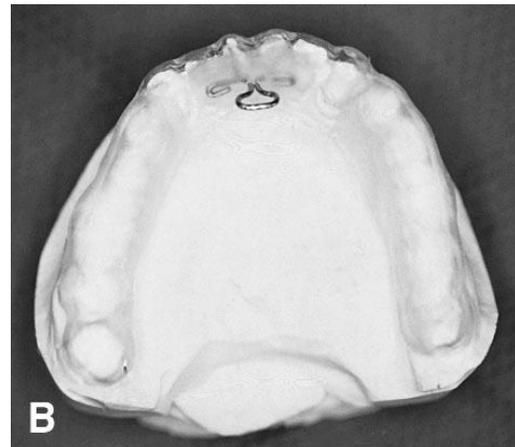
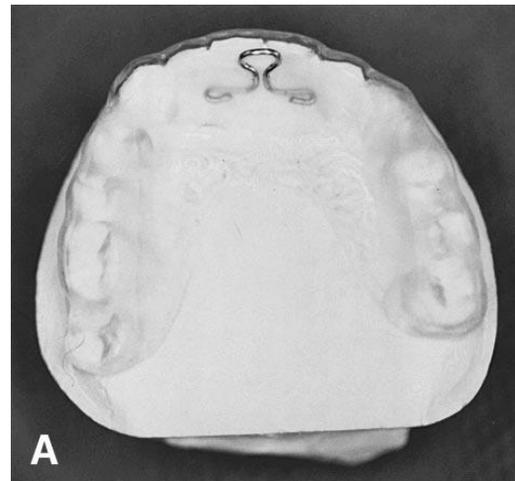


Figure 7: This appliance includes two separate hard acrylic splints

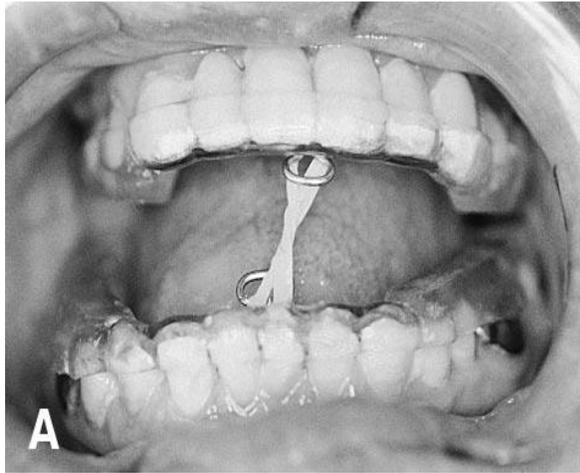
	Max opening	effectiveness	Acceptability by patients
Monoblock	4-6mm	High	High
Herbst	5-10mm	low	low

Herbst can retrude the tongue and result in more obstruction of the airway

The lower part has bilateral buccal flanges that extends superiorly in the posterior region and limits the expansion, caused by screws in the upper part. The two parts are very thin (1.5-2mm) so the vertical opening at least.<sup>6</sup>



**Figure 8: It causes mandibular rotation, tongue protrusion with suction plastic bulb between the lips and teeth that lets proper airway patency. It is more beneficial for edentulous patients.<sup>6</sup>**



**Figure 9: Elastic retracted OA is used especially in mental retarded and neuromuscular disabled patients. It is easily used and mandibular advancement can be adjusted.<sup>2</sup>**

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