

Analysis of Referrals for Mandibular Advancement Appliances for Sleep Apnoea

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How to cite this paper: Parmenter, D. and Millar, B. (2022) Analysis of Referrals for Mandibular Advancement Appliances for Sleep Apnoea. *Open Journal of Stomatology*, 12, 258-265.

<https://doi.org/10.4236/ojst.2022.129023>

Received: August 24, 2022

Accepted: September 23, 2022

Published: September 26, 2022

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Abstract

Aim: This article investigates the increasing awareness of Obstructive Sleep Apnoea (OSA) as a potentially serious health risk and highlights the role of the dentist in managing mild to moderate OSA cases which can be improved with an intra-oral mandibular advancement appliance. **Methods:** Data from referrals to a Prosthodontic Unit from 01-01-2019 to 18-8-2022 were analysed. **Results:** A total of 240 consecutive referrals to an NHS hospital where a patient was fitted with a mandibular advancement appliance (MAA) were analysed and 160 (67%) were male and 80 (33%) were female. The mean age in years was 52 (2019), 50 (2020), 52 (2021) and 51 (2022). Mean age of male referrals was 51 and female referrals was 53. **Conclusion:** There are a large number of patients with OSA seeking a dental device and practitioners should be aware of this treatment modality to help the medical team manage OSA. **Clinical relevance:** Dentists may need to have a greater understanding of OSA and be able to provide MAAs.

Keywords

Sleep Apnoea, Sleep Appliances, Mandibular Advancement, Referrals

1. Introduction

Obstructive sleep apnoea (OSA) is a sleep related breathing disorder, characterised by recurrent episodes of obstruction or narrowing of the upper airway during sleep [1]. Repeated airway obstruction causes recurrent episodes of absent or shallow breathing leading to hypoxaemia, eventually resulting in arousal from sleep [2] [3].

The consequences of OSA include excessive daytime sleepiness and neuro-cognitive dysfunction as a result of non-refreshing fragmented sleep which has an overall reduction in quality of life [4]. Untreated OSA can shorten life expectancy and result in serious comorbidities including hypertension, diabetes, stroke and heart disease.

Approximately 1.5 million adults in the UK suffer from OSA, however, despite a variety of simple and effective treatments being available for OSA, only an estimated 330,000 adults currently receive treatment [5].

OSA is more common in males than females and in overweight people of both sexes [6].

A BMI of over 25 kg/m² has been found to have 93% sensitivity for OSA and being aged over 65 increases the risk of developing the condition [7].

Sleeping in a supine position encourages the tongue and soft palate to fall backwards onto the back of the throat causing obstruction of the upper airway [8]. Macroglossia, excess fat in the palate or adenoidal tonsillar hypertrophy reduce functional space in the upper airway and predisposes young, healthy individuals to OSA.

Overnight sleep studies using pulse oximetry is the simplest way to confirm OSA, whilst polysomnography is reserved for more complex cases or where simple tests prove inconclusive. Overnight studies analyse breathing patterns and blood oxygenation and measure the number of cycles of shallow or absent breaths, known as the apnoea-hypopnoea index (AHI) score [5].

The Epworth sleepiness scale (ESS) is a subjective questionnaire which measures the severity of daytime sleepiness by asking patients how likely they are to fall asleep during certain situations [9]. The ESS cannot diagnose OSA but differentiates between simple snorers and OSA.

Management options

OSA treatment aims to improve an individual's quality of life by reducing daytime sleepiness and systemic health complications by reducing apnoea-hypopnoea index scores (AHI).

First line treatment involves recommendations such as weight loss, smoking and alcohol cessation and modification of sleeping position from supine to side sleeping [10].

Continuous positive airway pressure (CPAP) is the gold standard treatment for moderate to severe cases of OSA. A continuous pressure of warm, moistened air is delivered through a nasal or oro-nasal mask preventing airway collapse [11]. It is estimated that only half of patients tolerate prolonged CPAP therapy because of its side effects which include nose bleeds, sinusitis, nasal bridge sores and problems sleeping due to the bulk of the apparatus and operating noise [12] [13].

Oral appliances known as mandible advancement appliances (MAAs) are effective in managing mild and moderate OSA cases, or when patients with more severe apnoea don't tolerate CPAP. They are simple to make, non-invasive and cost effective [14].

Mechanism of action of MAA's

MAA's increase the volume of the upper airway and reduce the collapsibility of the soft palate by holding the mandible in an anterior position. They also hold the tongue in a forward position because of its mandibular muscle attachments, preventing it from falling onto the back of the throat and obstructing the airway [15]. These actions improve quality of sleep by reducing the number of apnoea and hypopnea episodes. MAA's significantly increase nocturnal oxygen saturation and decreases AHI scores, although not to as greater extent as CPAP therapy [16].

Vertical opening without protrusion does not affect the efficacy of MAA's and should be minimal to aid comfort [17]. Excessive vertical opening is counter intuitive as it encourages rotation of the mandible in an inferior and posterior direction which narrows and reduces the volume of the patient's airway [18].

The patient pathway

Patients are referred to a restorative new patient clinic at Kings College Hospital from the Department of Respiratory Medicine with a confirmed sleep apnoea diagnosis and symptoms.

Extraoral and intraoral soft tissue examination and an oral cancer screen are completed as this may be some patients only contact with a dental health care professional.

If dental pathology is noted during routine examination patients should be informed and encouraged to see a dentist in primary care. Patients are not denied MAA treatment if they choose to decline this advice, or they do not have a general dental practitioner as untreated OSA is associated with significant morbidity and potential mortality.

Upper and lower alginate impressions are taken to fabricate gypsum models to make the device on. An anterior bite registration which shifts the mandible approximately 5 mm anteriorly from its intercuspal position is recorded. The impression and bite registration are then sent to the laboratory for splint construction. The splint is made from thermosoftening plastic such as polyvinyl acetate polythene and is essentially two soft splints stuck together in the protruded position recorded during the first appointment. The patient is then invited back two weeks later to have their appliance fitted and aftercare instructions issued.

2. Methods

Clinical records were used to identify 240 consecutive cases from 1/1/2019 to 18/8/2021 where an MAA had been fitted. NHS ethics approval was checked and was not deemed necessary as this is an anonymous and retrospective audit. From the data for each year 2019-2022 the patient's age when the MAA was fitted was calculated. From this the mean age and age range were determined. The gender was also recorded. Only mild and moderate OSA cases (determined from the patients AHI score) were treated with an MAA and so excluded severe cases

of OSA which are treated with CPAP.

3. Results

Between 2019 and 2022, 240 OSA patients were referred to the Restorative Dentistry Unit at Kings College Hospital for MAA provision. Of these 240 patients, 160 (67%) were male and 80 (33%) were female. The overall mean age for male patients was 51 and 53 for female patients respectively. The overall mean age over the 4 years was 52 years. **Table 1** shows a breakdown of mean ages for male and female patients for each of the four studied years. This data has also been displayed in **Figure 1**.

Figure 2 shows the distribution of patients in different age cohorts. The age of patients being referred for construction of a mandibular advancement appliance shows a normal distribution as there is symmetry around the mean patient age. This shows there are more patients aged around the mean age of patients (52) and fewer patients further away from the mean.

Figure 3 displays the age distribution of patients referred for sleep apnoea treatment for each of the four years that the data was collected over. As in **Figure 2** the majority of patients are grouped around the mean and median values with a small number of outliers at high and low extremes of age.

Table 1. Overall, male and female mean ages of patients receiving mandibular advancement appliances at Kings College Dental Hospital between 2019 and 2022.

	2019	2020	2021	2022
Overall Mean	52	50	52	51
Male mean	52	51	52	48
Female mean	54	50	51	56

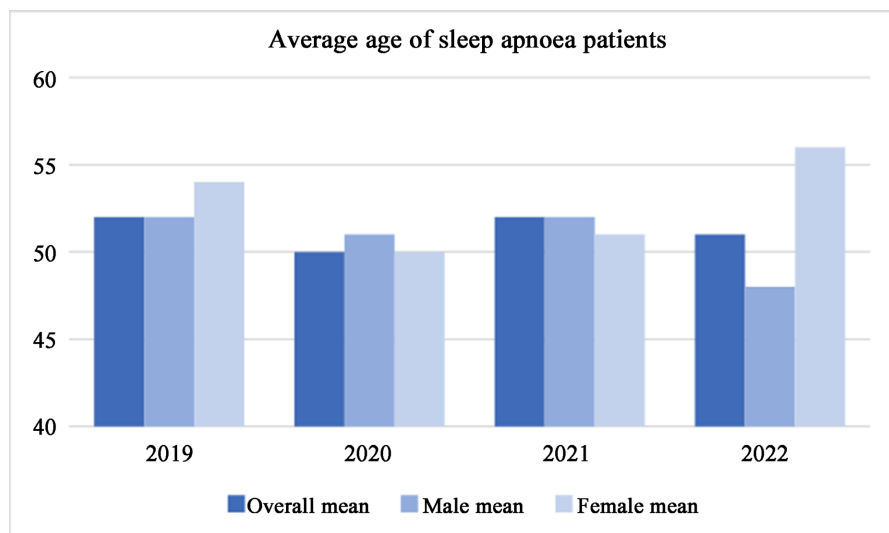


Figure 1. A visual representation of the data displayed in **Table 1** for the mean ages of sleep apnoea patients receiving a mandibular advancement appliance at the Kings College Dental Hospital.

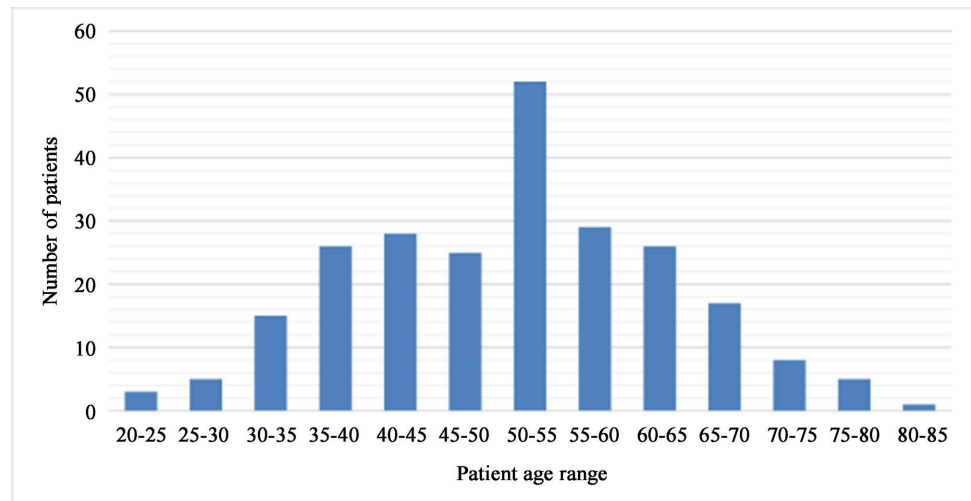


Figure 2. A visual representation of the distribution of patient age within our data sample.

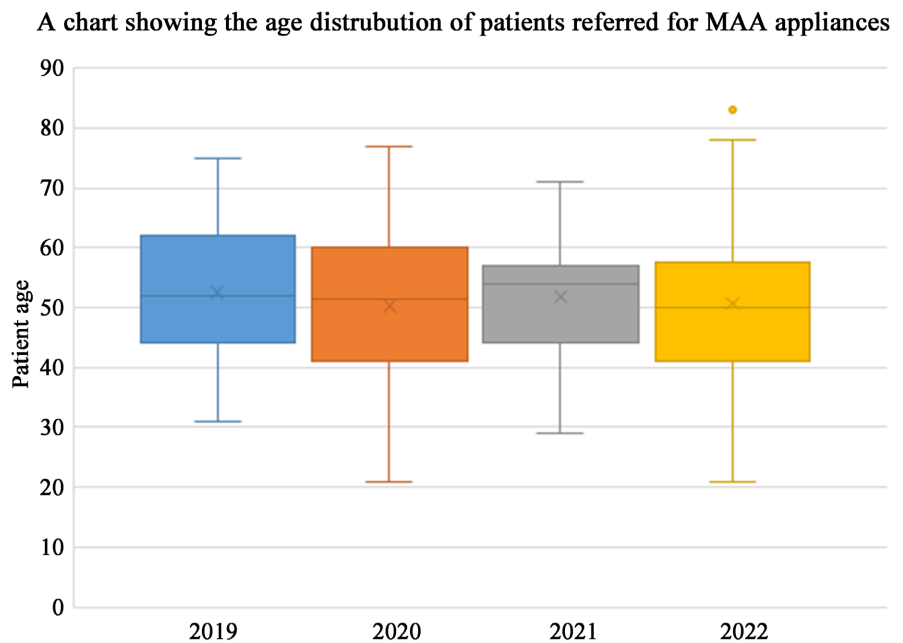


Figure 3. A visual representation of the distribution of patient age within our data sample between 2019 and 2022.

4. Discussion

Despite reduced referrals due to the Covid-19 pandemic resulting in a reduced number of hospital clinics the number of referrals is high. The reason for so many is likely to be the increasing awareness of Obstructive Sleep Apnoea within the public and the healthcare profession.

The data used in this analysis was only for cases treated with an MAA. We excluded severe cases where CPAP was used.

There was a 2:1 ratio of male to female patients in our sample which reflects similar observations in other epidemiology studies [6]. This could be down to social factors such as levels of alcohol consumption and smoking prevalence.

The most recent national health survey estimates that over twice as many men than women regularly drink alcohol at levels which increase the risk of ill health [19]. In 2019 16% of men in the UK smoked compared to 13% of women [19]. The most recent health survey for England in 2019 also found men to be more likely to be overweight or obese (68% of men, 60% of women) [20].

Men have larger nasal cavities and a larger pharyngeal cross-sectional area. The retro-palatal space is larger in males during wakefulness and sleep, suggesting the observed distribution is less likely to be down to anatomical variation. However, men also have larger neck diameters and a higher fat distribution at the level of the palate which may encroach on airway patency and increase airway resistance [21].

The 2:1 male to female ratio reported in this study also mimics a similar study carried within the Restorative Dental Unit at Kings College Hospital on tooth surface loss which reported a 1.7:1 male to female ratio for tooth wear referrals. The mean age of men being referred to the sleep apnoea clinic over the 4 years data was recorded was 51 and 53 for women, with the overall mean age being 52 years. Interestingly the mean age for patients referred to the dental hospital for tooth surface loss intervention was also 52 [22].

The data from this study on the demographic of patients being referred for sleep apnoea mirrors previously reported data on the demographic of patients being referred for tooth surface loss treatment. The similar demographic of patients could suggest that there is a close association in the etiological factors of both conditions and further research is required into the relationship of tooth surface loss and obstructive sleep apnoea. A positive association between the severity of tooth surface loss and the severity obstructive sleep apnoea has been reported [23].

Dentists frequently diagnose patients with tooth surface loss and so may be able to recognise patients of a similar demographic who may also have undiagnosed OSA. Therefore referral for further investigated should be considered. If the diagnosis is positive for OSA then the dentist may provide an MAA. Treatment is straightforward in providing an MAA as described in a recent paper [24].

5. Conclusion

As the awareness of OSA increases, the number of diagnosed cases will increase. In the future there will be an increasing treatment need which dentists should be aware of and could be involved in.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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