*The Journal of Laryngology & Otology*
July 2001, Vol. **115,** pp. 548–551

# Mandibular advancement prosthesis: first-line alternative to surgery in snoring

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**Abstract**

Mandibular advancement prosthesis (MAP) is infrequently used in the UK at present for snoring. First-line measures include dietary and weight modification for those that require it. Where such measures are unlikely to be useful or have already failed, surgery is sometimes utilized as a second-line treatment modality. We evaluate the use of MAP as an adjunct to first-line measures, with emphasis on efficacy, side-effects and patient compliance. Case notes of 30 snorers were reviewed and followed up with a questionnaire. Despite being useful in alleviating snoring, the prosthesis was poorly tolerated. Side-effects include increased salivation, temporomandibular joint pain, intra-oral and myofacial discomfort. Patients who persevered with the prosthesis found the early side-effects resolved after a few weeks and snoring reduced. MAP can be used in the initial management of snorers but patients need to be educated and encouraged, especially in the first few weeks.

**Key words: Snoring; Sleep Apnoea Syndrome; Mandibular Prosthesis; Patient Satisfaction**

## Introduction

Snoring as a disease entity covers a wide spectrum of pathology, ranging from mild snoring through to heroic socially handicapping snoring and, in more severe cases, may be associated with obstructive sleep apnoea syndrome (OSA). This is as a result of upper airway narrowing or blockage causing vibration or collapse of the tongue, soft palate and pharyngeal walls. Antisocial snoring has been reported in 11.2 and 15.6 per cent of middle-aged women and men respectively with a prevalence of OSA of 1.3–4 per cent, both indices rising with increasing age.[1–3] Snoring tends not to affect the patient *per se* but their 'nearest and dearest', i.e. family members, often find the loud habitual snoring intrusive. Frequently, snorers are forced to sleep in a spare bedroom. This can impact on family interactions and lead to disharmony. However, OSA due to intermittent upper airway obstruction during sleep, resulting in a poor sleep, early morning headaches and daytime somnolence can result in irreversible systemic pathology such as hypertension, cardiac and pulmonary sequelae. OSA has long been recognized as a serious condition requiring treatment. Blood oxygen desaturation has occasionally been found in subjectively healthy snorers, implying heavy snoring can be a precursor to developing OSA.[4,5]

Several studies have been published on the use of a mandibular advancement prosthesis (MAP) in the treatment of snoring and OSA.[6–8] To our knowledge, only one other UK institution[9] has published its experience with MAP use in OSA, but no UK institutions have published their experience with MAP relating to antisocial snoring in the absence of OSA. We present a retrospective pilot study of one such device in a UK teaching hospital.

## Method

A retrospective study was carried out in which the case notes of 30 snorers referred for a mandibular advancement prosthesis (MAP) at City Hospital, Birmingham were reviewed and followed up with a questionnaire. The extent of antisocial snoring, symptoms suggestive of OSA, recent weight gain, smoking, alcohol intake, Epworth score and past medical history were all reviewed, and height, weight, body mass index (BMI) and the sites of potential upper airways narrowing/obstruction were documented. In addition, the management decisions for the 30 snorers were analysed. Of the 30 patients, only 22 attended and were fitted with the 'SILENSOR snoreguard' MAP but one subsequently never used the device. Eight patients failed to attend.

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Presented at the XVIII Congress of European Rhinological Society. 25-29 June 2000. Barcelona, Spain.
Accepted for publication: 23 January 2001.

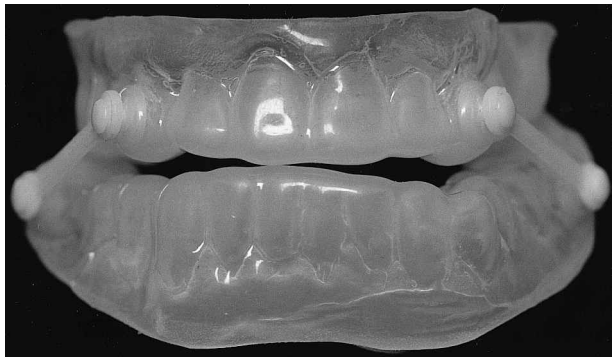

FIG. 1
The 'SILENSOR snoreguard'.

The 'SILENSOR snoreguard' comprises a pair of removable occlusal splints with full dental coverage of the patient's top and bottom teeth, which helps to avoid any orthodontic changes which might otherwise occur.[10] The two sections are made of clear acrylic plastic and connected at the sides by short plastic links (Figure 1), which are placed so as to provide an average anteriorization of the lower jaw by 3 mm with the purpose of alleviating snoring. The mouldings are made from dental impressions taken from individual patients in the City Hospital. One patient previously had the more established 'one-piece mould' device but this has the disadvantage of not allowing movement of the jaw in any plane whilst asleep (Figure 2).

Patients were questioned about the efficacy of the MAP, and whether they noticed a change in snoring and to what degree. Other variables included subjective quality of sleep and Epworth Score before and whilst using the device. Patient compliance was assessed with regards to how frequently the MAP was worn at night and for how many nights. Side-effects commonly associated with MAPs include excessive salivation, TMJ pain, intra-oral pain and myofacial discomfort. Patients were asked if they experienced any of these symptoms, to what extent, whether these settled and, if so, how long they took to settle.

## Results

Review of the case notes revealed all 30 patients had been snoring for longer than one year, while some had symptoms dating back to childhood, the longest being 56 years. In addition, the snoring was severe enough

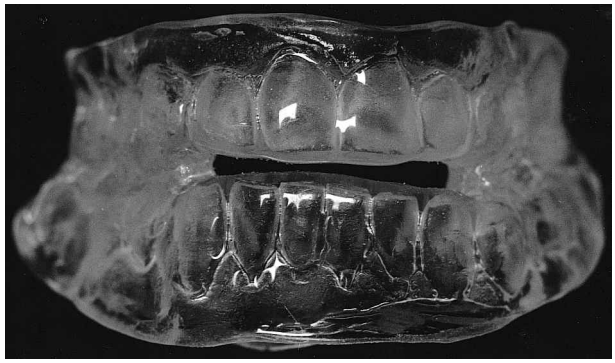

FIG. 2
The 'one-piece mould'.

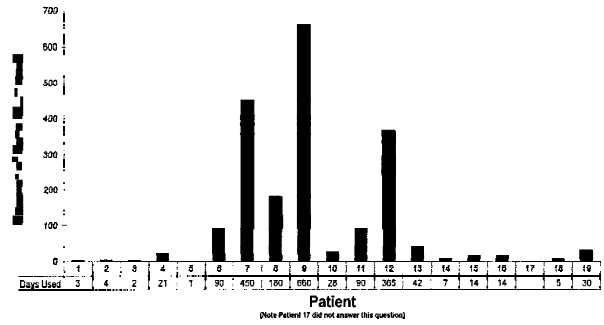


FIG. 3
Compliance of MAP use.

to disturb the partners' sleep and in most cases loud enough to be heard behind closed doors. Physical examination revealed the majority of patients had a bulky or floppy palate or redundant pharyngeal mucosa, three patients had marked tonsillar hypertrophy and one had macroglossia. None had any significant micrognathia. Patients had not undergone any previous palatal surgery for snoring.

Three snorers also suffered with OSA, having failed to tolerate a trial of continuous positive airway pressure (CPAP). All three had episodes of apnoea witnessed by their partners, although witnessed episodes were not uncommon in patients who subsequently had normal sleep studies. The Epworth Sleepiness Score was not particularly useful for distinguishing OSA from heroic snorers in this series. However, all three OSA patients were noted to have multiple sites of potential upper airway obstruction on physical examination. These patients have successfully used MAP.

Twenty-two of 30 patients attended the maxillofacial department and 21 subsequently used the MAP. Nineteen out of 21 replied to the questionnaire. Patients wore the MAP from between one night to 22 months, with a median of 25 days (Figure 3). Ten wore the device for 28 days or less, seven complaining of side-effects severe enough to stop using the prosthesis (excessive salivation in four, intra-oral pain in two, both in one) and three complaining of no benefit with regards to reduced snoring. Four patients had late onset of side-effects sufficient enough to stop wearing the prosthesis ranging from 30 to 180 days. Patients with mild or moderate side-effects noted their symptoms usually settled within three to four weeks. The frequency and severity of specific symptoms is shown in Figure 4.

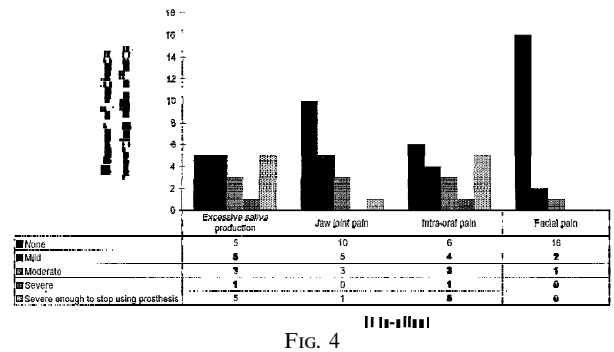


FIG. 4
Side-effects of MAP use.

https://doi.org/10.1258/0022215011908469 Published online by Cambridge University Press

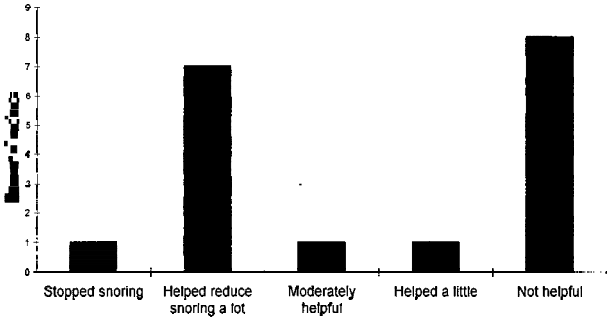


FIG. 5
Effectiveness of MAP at reducing snoring.

Overall, patients fell in to two groups: nine felt the device helped to reduce snoring and 10 thought it was of no or little benefit (Figure 5). There was no significant effect on subjective sleep quality and Epworth scores as measured before and whilst using the prosthesis (chi-square and Student's *t*-tests, respectively). Similarly, patients did not feel there was any effect on their general well-being. There was no significant change in body mass index between dispensing the prostheses and the date of the study (Student's *t*-test). Twelve patients would probably recommend a trial of the prosthesis to a friend or relative with a snoring condition, four would not and three were unsure.

## Discussion

In the UK, first-line measures to alleviate snoring typically include weight reduction, dietary modification, reducing alcohol intake and treating any easily reversible cause of upper airway obstruction. If these simple measures fail, which is not too infrequent, then surgical alternatives are explored if there is no evidence for OSA. Surgery aims to enlarge the upper airways in heroic snorers and though short-term success rates for pharyngeal snoring surgery are often quoted with an efficacy range of 61–100 per cent,[11,12] it is well recognized that relapse is common when followed up long-term. Outside the UK, surgery is widely accepted in the management of OSA with quoted success rates of 48–66 per cent.[13–16] Interestingly, surgical advancement of the mandible in OSA has been advocated with anterior inferior mandibular osteotomy and was associated with initial success but failed at 12 months.[17] This was thought to be a result of gradual adaptation of the muscle groups around the hyoid such that long-term widening of the pharyngeal airway was not maintained. However, surgery in OSA is not without potential risk for perioperative morbidity and mortality, with airway obstruction, haemorrhage and arrhythmias being well recognized complications.[18] Perioperative deaths and life-threatening morbidity is not exclusively limited to OSA and has also been reported in non-OSA patients.[19]

Continuous positive airway pressure (CPAP) is effective in OSA,[20] but side-effects leading to poor patient compliance include mask intolerance, air leak, nasal congestion and discomfort.[21] CPAP is better than MAP in severe OSA but compliance with CPAP in those with mild symptoms reduces in the long-term.[9,22,23] The three OSA patients in our series had poor tolerance to CPAP therapy but successfully used MAP, resulting in reduction of snoring and control of their OSA. MAPs have been shown to improve sleep study outcome measures and, more importantly, patients subjectively report improved symptom control.[24]

MAP is fitted with the intention of anteriorizing the mandible and tongue to reduce the likelihood of pharyngeal obstruction. It can be considered as an adjunct to first-line measures, is minimally invasive, inexpensive and requires little maintenance. Cephalometric studies have shown mandibular advancement to increase the pharyngeal airway, reducing tongue contact with the soft palate and posterior pharynx alleviating snoring and OSA.[25,26] Videoendoscopy, performed in the awake individual, supports the finding of increased cross-sectional airway space whilst wearing a MAP.[27] A favourable response to MAP suggests a probable favourable response to surgical measures to advance the mandible. However, unlike surgical measures such as inferior mandibular osteotomy, MAP provides temporary advancement during the night while worn and seems to avoid the long-term risk of relapse associated with possible adaptation of the pharyngeal musculature.

Side-effects are common and unfortunately MAP was not as well tolerated in our series as in previously reported series.[8,26,28,29] Schmidt-Nowara, in a review of 21 publications, found that long-term compliance varies from 50 to 100 per cent.[24] Initial side-effects usually resolve in three to four weeks after starting therapy.[28,29] Reasons for non-compliance in the present study were attributed to side-effects followed by failure to reduce snoring and, infrequently, inability to hold the prosthesis in the oral cavity. Side-effects were usually minor and proved to be temporary in those that persevered but a significant number of individuals stopped using MAP within four weeks and therefore the prosthesis failed to realize its full potential. Sensation of altered occlusion was not reported by any of the patients but a shortcoming of this study is that no quantitative assessment of malocclusion or orthodontic change was possible. Long-term use of MAP can cause a small but significant forward and downward change of mandible position, but this usually remains unnoticed by the patient.[10] Knowledge of potential side-effects, prevalence and likely outcome is useful in improving patient compliance, especially as treatment may be long-term.

Adding MAP to the arsenal of first-line measures for snoring and OSA would provide benefit. In addition it would be particularly useful in patients awaiting surgery, and in some cases surgery has been avoided altogether after a favourable response to mandibular repositioning. In our series, half the patients did benefit from MAP; we would not expect this to change with time and is comparable to long-term success rates in pharyngeal snoring surgery.[30] Mandibular advancement would also provide temporary relief from snoring whilst patients lose

weight, give up smoking or cut down on alcohol consumption. Where such lifestyle changes are effective in bringing about reduction in snoring, continued use of the prosthesis or surgery might no longer be needed, as recognized by others.[31] Long-term MAP is considered in those who fail to lose weight and would therefore be poor candidates for conventional palatal surgery.

In conclusion, MAP can be a useful conservative measure in dealing with snorers with and without OSA. Most patients will have some initial side-effects but these tend to subside within four weeks after starting therapy. However, in some, the side-effects can become intolerable, leading to abandonment during the first four weeks. We feel these patients could probably successfully overcome these difficulties with improved education, encouragement and after care. If MAP is used as a first-line treatment, we hope to avoid surgery in half the snorers. If surgery is reserved for those who fail MAP, we envisage we would be able to help up to 75 per cent of patients referred for antisocial snoring. A long-term prospective study is needed to demonstrate the compliance, benefits, efficacy and side-effects of long-term MAP use.

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Mr S. Minhas takes responsibility for the integrity of the content of the paper.
Competing interests: None declared