The Surgical Management of Obstructive Sleep Apnoea: A Case Report and Review of the Literature

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Received Date: Feb 08, 2017, Accepted Date: Feb 13, 2017, Published date: Feb 20, 2017

Abstract

Introduction: Obstructive Sleep Apnoea (OSA) is a sleep related breathing disorder caused by the partial or complete obstruction of the upper airways. Left untreated, OSA can impact detrimentally on the patient's quality of life, and is a risk factor for hypertension, cardiovascular morbidity and mortality and stroke. We report on a case of OSA treated by Maxillomandibular Advancement (MMA) surgery and review the literature for this type of surgery and other treatment options for OSA.

Case: A 55 year old male was referred to our Maxillofacial Hospital Department for surgical review and management of his debilitating OSA. Throughout most of his adult life he had been plagued by this condition, and reported adverse effects on his work, family and social life. He had previously tried multiple medical and surgical management options, none of which provided him with any long term improvement. He proceeded to MMA surgery, which advanced his maxilla 8mm and mandible 18mm. This resulted in significant enlargement of the pharyngeal space by expanding the skeletal framework. On follow up he patient reported a significant improvement in his quality of life.

Discussion/Conclusion: This case highlights the evidence demonstrated in the literature to date – there is an increasing body of evidence that MMA is the most effective surgery for OSA. This type of surgery should be considered when medical therapy has failed or is not tolerated, and patient anatomy suggests other surgical procedures are not likely to produce significant benefit.

Introduction

Obstructive Sleep Apnoea (OSA) is the most common sleep disorder seen in primary and secondary care [1]. It is caused by the complete or incomplete collapse of the soft tissues of the pharynx during sleep [2]. This results in repeated episodes of apnoea (airflow cessation) and hypopnoea (airflow reduction); recurrent bursts of hypoxemia, chronic daytime fatigue and a diminished quality of life [3]. Risk factors include obesity, male gender, advancing age and constricted oropharyngeal anatomy [1,4]. When left untreated, OSA is a recognised independent risk factor for hypertension, cardiovascular disease, arrhythmias, stroke, impaired glucose tolerance and motor vehicle accidents [5-7]. The gold standard for the diagnosis of OSA is overnight polysomnography (PSG) [1] This measures a range of physiological parameters, as well as episodes of apnoea or reduction. The apnoea-hypopnoea index (AHI) provides a measure of the severity of OSA, with an AHI <5 considered normal, and a score >40 considered to represent severe OSA [8].

Management of OSA includes both non-surgical and surgical options. Non-surgical options include lifestyle interventions [9], Oral Appliance (OA) therapy [10] and Continuous Positive Airway Pressure (CPAP) devices [11]. There are a number of surgical soft tissue procedures advocated for the treatment of OSA that aim to increase the posterior airspace and reduce the collapsibility of the soft tissues [12]. Maxillo-Mandibular Advancement (MMA) is a surgical treatment option performed by Oral and Maxillofacial surgeons (OMS) that advances the maxilla and mandible. This in turn enlarges the pharyngeal space by expanding the skeletal framework [13]. The pharynx and tongue are less likely to collapse during negative-pressure inspiration. There is an increasing body of evidence that this is an extremely effective and safe treatment option in the management of OSA [4,11-13].

We present a case that highlights the benefit of MMA in OSA. We discuss the evidence for MMA as an effective treatment for OSA and contrast this with the other treatment options available.

Case Report

A 55 year old male was referred to the Oral and Maxillofacial Surgery (OMFS) unit at Counties-Manukau District Health Board (CMDHB) for consideration of MMA for treatment of OSA. He described having symptoms of OSA that adversely affected his work, family and social life throughout most of his adult life. Multiple treatment modalities had been undertaken prior to his referral, but none of these had provided any long term improvement.

On review of his history he recalled having poor quality, broken sleep with associated daytime sleepiness since his early twenties. These symptoms had progressively worsened with time. The most alarming of these was frequent apnoeas from which his wife had to shake him awake. His BMI was in the normal range and his medical history was otherwise unremarkable.
The Epworth Sleepiness Score (ESS) was used to subjectively assess his daytime sleepiness. This was 20, which meant he was very likely to fall asleep in a number of common situations (e.g., watching TV, sitting while conversing). Over time he had developed various methods to cope with his symptoms of daytime fatigue. He consciously avoided situations where he knew he would easily fall asleep (e.g., slow motorways in Auckland, cinemas). The avoidance of certain situations had been detrimental to his personal life, and he found it difficult to spend quality time with his wife and child. These methods extended into his work (regular walking, standing during meetings) which he felt intruded on his co-workers, but were necessary to maintain his attentiveness.

With regard to his lifestyle he was not overweight, had minimal alcohol intake and led an active lifestyle where possible. He had trialed an OA, but discontinued it as it shifted his teeth. CPAP had been trialed on two separate occasions, but each attempt had only lasted a few months as he found it difficult to tolerate. He had undergone Uvulopalatoplasty (UPPP) approximately twelve years ago that helped with his snoring but had not improved his daytime sleepiness. Two years after this he underwent further surgery – genial tubercle advancement. This surgery is usually done in conjunction with UPPP and advances the tongue musculature forward to help increase posterior airway space, but unfortunately it failed to produce any significant improvement.

The following images and radiographs show the patient’s frontal and lateral profiles view prior to surgery (Figures 1-3).

With worsening OSA despite these procedures, our patient decided to pursue MMA. He obtained a referral to the Oral and Maxillofacial Department at CMDHB where his case was reviewed. A polysomnograph study showed his pre-operative AHI was over 60/hour. He was offered MMA surgery and underwent advancement of his maxilla and mandible. The maxilla was advanced 8mm, his mandible 18mm, and this significantly expanded his posterior airway space. There were no intraoperative surgical complications. The postoperative images illustrate the resulting alteration in facial structure and extent of surgical movement. The lateral cephalograph demonstrates the increase in size of the posterior airway space following surgical advancement (Figures 4-6).
Following the surgery and recovery period there was significant improvement in all facets of the patient's affected life. His postoperative ESS had dropped from 20 to 4. A polysomnograph taken 3 months after surgery showed an AHI of 1.2/hour. An AHI <5 is deemed is used in the literature to define a surgical cure [4]. The patient noted improved sleep patterns that were less intrusive on his partner, and he was able to take up a new job confident that he would not have issues with daytime fatigue. He also felt safer driving on motorways, and was pleased to be able to spend more time with his family.

Discussion

OSA is a caused by repetitive narrowing, collapse and blockage of the upper airways during sleep, resulting in repeated episodes of apnoea and hypopnoea. As airway obstruction can occur at multiple pharyngeal levels, management of OSA can be difficult and require multiple treatment modalities before significant improvement is achieved. The prevalence of OSA is reported to be 4% in adult males and 2% in adult females [14], with Maori twice as affected as non-Maori in New Zealand [15]. Obesity is the major risk factor for OSA, with increased incidence also noted in smokers, hypothyroid patients and females with polycystic ovary syndrome [8]. Research has shown OSA is associated with hypertension, increased risk of cardiovascular events, metabolic syndrome and diminished quality of life [1].

There is also increased risk of motor vehicle and workplace accidents, and a New Zealand study found one-third of drivers admitted to the Wellington Hospital Emergency Department after motor vehicle accidents (MVA) had OSA [7]. Many treatment modalities ranging from conservative to surgical have been advocated for OSA. In terms of improving quality of life, the cost associated with OSA treatment is below the average cost of the drugs selected by PHARMAC to receive government subsidy in New Zealand [6]. The treatment of OSA is cost effective. Lifestyle interventions are the safest and simplest approach to improving OSA. These include the avoidance of alcohol and medications (e.g. benzodiazepines) that can relax the upper airways. OSA is twice as prevalent in obese individuals compared to those of normal weight [16] and reducing weight and increasing physical activity may help improve symptoms. A systematic review conducted to investigate the effectiveness of lifestyle interventions on OSA concluded that weight loss interventions are useful in the early stages of disease, but are not curative [9]. Often patients find long term control of their weight difficult, and there are no long term follow up studies of high quality available at present.

OA therapy involves the use of a removable oral appliance that aims to open up the airway during sleep by advancing the lower jaw forward or keeping the mouth open during sleep. This has been shown to reduce daily fatigue associated with OSA, and also to reduce AHI [10]. The use of these appliances are associated with frequent but minor side effects including excessive salivation, tooth and jaw discomfort, loosening of teeth and temporary bite changes, however some studies have shown patient's may prefer this treatment over CPAP [17]. A negative response to OA is not a contraindication to MMA, which also advances the maxilla and increases airway volume at multiple levels [18]. CPAP is the recommended first line treatment for moderate to severe OSA [1]. It works by pneumatically stenting the upper airway open, preventing obstruction during sleep. If tolerated it is extremely effective at reducing daytime sleepiness, lowering arterial blood pressure and decreasing the rate of motor vehicle accidents. However it is an intrusive treatment option, and patients are often non-compliant. Our patient attempted CPAP on two separate occasions, with some benefit, but like many others could not tolerate using the device long term. A recent systematic review has suggested that the concept of CPAP as the gold standard therapy for OSA should be revisited [11]. This study reviewed 83 closely supervised CPAP trials and found the average patient did not use it 32.9% of the time. This is problematic as there is strong evidence CPAP should be used at least 5-6 hours a night for achieve benefit.8 When prescribing treatment for OSA it is important to evaluate individual anatomy as well as OSA severity, as in many patients surgery may be warranted.

A number of surgical soft tissue procedures are advocated for treatment of OSA by either increase posterior airspace or reducing the collapsible soft tissues. These include Uvulopalatopharyngoplasty (UPPP), Laser Assisted Uvuloplasty (LAUP), Upper Airway...
Radiofrequency Treatment (RAF) and Soft Palatal Implants. The American Academy of Sleep Medicine (AASM) published a systematic review and meta-analysis of these treatments, finding a reduction of 20-40% in AHI following these procedures [12]. The low success rates may be due to pharyngeal restriction in OSA occurring at multiple levels. The study noted that given the lack of high level evidence available, it was difficult to recommend definitive practice guidelines for these procedures. There is an increasing body of high level evidence that MMA can significantly improve OSA [4,5,11-13,18]. It is considered to be comparable to CPAP in effectiveness, but without the issues of treatment adherence. A systematic review and meta-analysis of MMA in the treatment of OSA showed a mean decrease of AHI from 63.9/hour to 9.5/hour (p<0.001) [13]. The surgical success rate (defined by >50% reduction in AHI post-surgery) was 86% with a cure rate (AHI <5/hour) of 43.2%. Following surgery the majority of patients in the study reported improvement in quality of life measure and OSA symptoms. Complication rates were low – between 1-3%, with no deaths reported. Recent research that has evaluated the long term effectiveness of MMA showed that for patients with moderate to severe OSA, there are substantial and sustained reductions in AHI, BP, and quality of life [4,11]. This case highlights the multiple types of treatment modalities available for the management of OSA. It is easy for patients to become disillusioned in the search for improvement in their symptoms if initial conservative treatment or CPAP fails, and if the costs associated with specialist treatment are unaffordable. It is important for General Practitioners to be able to diagnose and counsel patients who suffer from OSA, and refer to the appropriate hospital departments for polysomnography and specialist advice when necessary.

Conclusion
MMA should be considered when medical therapy has failed or is not tolerated, and patient anatomy suggests other surgical procedures are not likely to produce significant benefit. Referrals can be made to Oral and Maxillofacial surgeons both through private and public avenues. At the moment funding for MMA surgery varies by the various national District Health Boards, and is usually on a case-by-case basis using clinical prioritization.

References