# 78 What is New in Surgical Treatment of Snoring and Obstructive Sleep Apnea in Adult?

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Snoring is a common problem encountered in Thailand. The actual prevalence in Thailand is unknown, but it is estimated to be 20% in male and 5% in female. People mostly understand that snoring is normal in daily life, but it actually indicates upper airway obstruction. It is very annoying to patients' bed partners since it could deprive them from proper and restful sleep, which is essential to good health. Snoring most often results from collapse of excess soft tissue in the soft palate, tonsillar pillars, tongue, tongue base, and hypopharyngeal walls. If the degree of such an obstruction is severe, it can lead to obstructive sleep apnea (OSA), which is a life-threatening condition. Snoring and OSA belong to a broad group of breathing abnormalities termed sleep-disordered breathing (SDB). OSA is characterized by periodic collapse of the upper airway during sleep, which leads to either complete (apneas) or partial airway obstruction (hypopneas), or both, resulting in arousal and oxygen desaturation. Risk factors for this condition include obesity, anatomical abnormalities, aging, male sex, and family history. The prevalence of OSA increases with age, although the severity of the disorder, as well as the morbidity and mortality associated with it, may actually decrease in the elderly. Recognition of OSA is important since it causes daytime somnolence, neurocognitive defects, chronic fatigue, and depression. In addition, it can increase the risk of having accident, hypertension, cardiovascular disease, stroke, pulmonary hypertension, and cardiac arrhythmia.

From the clinical point of view, the most important practical points are; firstly the differentiation among primary snoring, upper airway resistance syndrome, and OSA, and secondly, the quest for point(s) of airway obstruction. The former can be done by overnight polysomnogram, which remains the gold standard for the diagnosis

of OSA. The latter can be achieved by rigid and flexible endoscopy of the upper airway.

The treatment options for snoring and/ or OSA include weight loss, positional therapy, oral devices, continuous positive airway pressure (CPAP), and surgery. Weight loss significantly decreases or eliminates snoring and/ or apneas. Positional therapy involves avoiding the supine position during sleep in patients who mostly snore or have apneas while lying on their back. Oral appliances are used to enlarge the airway at night by moving the tongue and mandible forward. CPAP is a device, which generates positive air pressure through a nose mask, creating a splint that keeps the airway unobstructed throughout the night. Although CPAP is the most efficacious and widely used therapy, the compliance of using this modality is low because of its complication e.g. nasal congestion or dryness, mask discomfort.

Surgery offers a viable alternative to nasal CPAP in patients who are intolerant of nasal CPAP. Potential risks and complications must be explained fully to any potential surgical candidate. The selection of surgical procedure(s) should be determined based on a patient's airway anatomy, medical status, severity of sleep apnea, and his or her desire and preference. The aim of surgical treatment of SDB is to enlarge the size of upper airway and correct anatomic abnormalities at multiple levels of the upper aerodigestive tract. The point of obstruction in the upper airway starts from nasal cavity, nasopharynx, oropharynx, and hypopharynx. The most common site of obstruction in adult is oro- and hypo-pharynx. The type of surgery depends on the type and location of the pathology. There are usually multiple, difficult-to-evaluate sites of airway collapse, which make it challenging to predict which operation will benefit. This also explains why the surgical correction of obstruction at one level has a limited success and why surgery is often less successful than CPAP in treating OSA. Thus, determination of the site (or level) of obstruction is a predictor of the success or failure of any proposed surgery. A clinical staging system has been proposed to identify those clinical features of a disease process that can predict the suitable treatment option and the success rate of the single or multiple modality treatment.[1] The system is based on three easily identifiable and reproducible clinical findings: palate position, tonsil size, and body mass index.

Surgery for correction of nasal obstruction has been shown to have beneficial effects on nocturnal nasal breathing in patients with SDB. It not only helps to relieve nasal obstruction, but also facilitates the use of nasal CPAP.[2] A variety of procedures are available to correct nasal obstruction secondary to deviated nasal septum (e.g. septoplasty), turbinate hypertrophy (submucous diathermy, radiofrequency volumetric tissue reduction (RFVTR), outfracture of the turbinate, submucous turbinoplasty, turbinectomy, intraturbinal use of Nd: YAG laser) or nasal valve abnormalities. Yariktas and colleagues[3] recently reported a significant improvement in snoring complaints in patients undergoing septoplasty for causes other than snoring.

Patients who benefit most from correction of nasal obstruction as a sole intervention are probably those with the mildest forms of SDB without other significant predisposing anatomic abnormalities.

The surgical options available for the obstruction at oropharyngeal level are uvulopalatopharyngoplasty (UPPP), laser-assisted uvulopalatoplasty (LAUP), uvulopalatal flap (UPF), injection sclerotherapy, and mandibular osteotomy with genioglossus advancement. Surgical therapies for hypopharyngeal obstruction include midline glossectomy, mandibular advancement, and hyoid suspension.

UPPP is the most common surgical procedure performed for SDB. It is designed to eliminate palatal and pharyngeal redundancy by resection of excess loose palatal and pharyngeal mucosal and submucosal tissues. It is recommended for treatment of non obese or mildly obese snorers with mild to moderate OSA who are resistant to (or intolerant of) CPAP and in whom correctable anatomical abnormalities in the oropharyngeal and palate areas are identifiable. The advantage of UPPP over other outpatient uvulopalatal procedures is the pharyngeal component of the procedure. Removal of tonsils and other redundant pharyngeal folds is followed by lateralization, suture fixation, tightening, and stabilization of the pharyngeal airway below the palatal level. Submucosal UPPP has been introduced by Friedman and colleague[4] to provide faster wound healing, less postoperative pain, and sutureline dehiscence.

LAUP is an outpatient surgical procedure which the uvula and soft palate are reduced and reshaped with the laser to increase the oropharyngeal airway size and reduce the vibratory soft tissue. It excises only the uvula and associated soft-palate tissues and does not remove or alter tonsils or lateral pharyngeal-wall tissues. The LAUP procedure is most often performed to alleviate snoring. It provides good and lasting results in snoring improvement if performed correctly in properly selected patients. The snoring reduction is assessed 4 to 6 weeks after surgery to determine if additional treatments are needed. The procedure is repeated if the patients still snore. Ferguson and colleagues[5] performed a randomized trial of LAUP in the treatment of mild OSA. The respiratory disturbance index (RDI) post-LAUP was reduced by 21% overall compared with no change with the control group at outcome, and 48% of patients reported significantly improved snoring after the LAUP. Kern and colleagues[6] recently demonstrated that LAUP with adjunctive tonsillectomy is an effective treatment for patients with moderate to severe OSA and retropalatal obstruction with a lower complication rate than UPPP. Furthermore, Prasad and colleagues[7] reported the partner satisfaction, following LAUP and UPPP, using questionnaire-based survey, with a minimum follow-up of 1 year. There was a highly significant reduction in the disturbance of sleep and need to wake up and a significant improvement in quality of life after both types of surgery although residual snoring and the presence of trouble falling asleep was even more frequently following LAUP than it was following UPPP. These recent studies demonstrate the effectiveness

of LAUP in the treatment of SDB. In addition, electrocautery can be used for outpatient cautery-assisted uvulopalatoplasty, which the tissue excision is the same as in LAUP. This technique is more economical and does not require special training or safety precaution.

A one-stage UPF is a relatively new palatal technique, which can be performed in the outpatient setting under local anesthesia or under general anesthesia. The mucosa on the lingual surface of the uvula and soft palate is removed with cold knife dissection. The uvular tip is then amputated, and the uvula is reflected back toward the soft palate and sutured. While LAUP is technically easy to perform, but has several drawbacks. It requires the availability of a laser and is staged over several months in multiple procedures. UPF does not require the purchase of any additional equipment, and is easy to perform. It also offers potential advantages over the traditional UPPP in maintenance of palatal dynamics, lessened chance of scar contracture, reversibility, and lessened pain. One recent study assessed the efficacy of UPF for the treatment of simple snoring under local anesthesia.[8] Significant improvement was observed in snoring scale and mean snoring index with the overall success rate of 88%. Li and colleagues[9] reported the favorable surgical outcomes of a modified UPPP-extended UPF, which consisted of bilateral tonsillectomy, dissection and removal of submucosal adipose tissue of the soft palate and supratonsillar area; imbrication; and reposition of the denuded uvulopalatal flap, in the treatment of OSA. Six months after operation, there was a significant decrease in mean RDI and a significant improvement in mean minimal oxygen saturation and snoring index.

Injection snoreplasty is a popular technique as a primary treatment of palatal snoring. A sclerotherapy agent is injected submucosally into the midline soft palate to induce fibrosis, which diminishes palatal flutter snoring. It is simple to perform, minimally painful, highly effective, and inexpensive.

Tongue base hypertrophy and collapse is a problematic component of OSA. Treatment of this area requires invasive surgery with high morbidity. A new minimally invasive technique that achieves stabilization of the tongue base has been described. It uses a soft tissue to bone anchor inserted intra-orally into the mandible with an attached prolene suture that is passed through the tongue. Rigidity is added to the airway after incorporation of the suture in the tongue musculature. More recently, Suzuki and colleagues[10] performed lingual tonsillectomy using a new ultrasonic coagulating dissector (SonoSurg®) in patient with snoring and OSA. This instrument converts ultrasonic vibrations into energy, which minimizes bleeding by coagulating as it cuts tissue. They found that it shortened operative time and was effective and safe. Patients had less postoperative hemorrhage and pain, faster recovery, and shorter stays.

Hyoid myotomy with suspension and a mandibular osteotomy with genioglossus muscle advancement provide a high rate of surgical success. Neruntarat[11] performed

hyoid myotomy with suspension in the treatment of hypopharyngeal obstruction of 32 patients with OSA under local anesthesia and assessed its safety and efficacy. There were significant decreases in RDI, Eqworth sleepiness scale, snoring scale and a significant increase in the lowest oxygen saturation with a low probability of complications. Also, successful results of genioglossus advancement and hyoid myotomy with suspension under local anesthesia in the treatment of hypopharyngeal obstruction has been demonstrated by the same author.[12]

In retractable case, distraction osteogenesis can improve airway obstruction by expanding the maxillofacial skeleton. In individuals who require more aggressive advancement of the hypopharyngeal airway, maxillary-mandibular advancement is an effective mechanism to maximize their airway space.

The novel radiofrequency procedures are technically simple, minimally invasive and are associated with reduced postoperative pain and discomfort compared with traditional surgical procedures. It can be done on an outpatient basis under local anesthesia with a low complication rate and good therapeutic results.[13] A current from the electrode causes electrical arcs to form across the physical gap between the probe and the target tissue. At the contact point of these arcs, rapid tissue heating occurs. Consequently, cellular fluid rapidly vaporizes into steam, causing the release of cellular fragments and producing a layer of necrosis or dead cells along the pathway of the probe. As a result of this heating, collateral tissue ablation is produced in regions surrounding the target tissue site. This leads to the creation of a vascular degeneration in the affected tissue. Over a course of several weeks following the initial treatment, firmer fibrous tissues forms reducing the tissue volume with less vibration. Soft palatal radiofrequency reduces the volume of palatal soft tissue and produces scar tissue to alleviate velophayngeal vibration and collapse in snoring and mild SDB. Said and Strome[14] conducted telephone interviews to assess the long-term efficacy (average follow-up of 14 months) and morbidity of RFVTR of the soft palate for snoring. The majority of patients responded favorably to treatment without significant complications or long-term sequelae. Rombaux and colleagues[15] recently compared the side effects and the postoperative complications of UPPP, LAUP, RFVTR for the treatment of primary palatal snoring. The data reveal that RFTVR is a safer and less painful procedure and has less complication rate than UPPP and LAUP.

RFVTR for hypertrophic inferior turbinate is effective in patients with retractable nasal obstruction who fail conventional treatments. Radiofrequency tongue base and tonsil reduction is an alternative technique of improving upper airway patency by reducing the size of the tongue and tonsil. This modality is a multiple-staged procedure separated by approximately 4 weeks, performed in an out patient setting using local anesthesia with minimal discomfort and morbidity. Fischer and colleagues[16] evaluated the safety and

efficacy of multilevel radiofrequency application to soft palate, tonsils, and base of tongue in 15 patients with moderate to severe OSA. Every patient received 16 treatment sites with a total dose of 9750 J radiofrequency energy into soft palate, base of tongue, and tonsils. There were significant decreases in score on Epworth Sleepiness Scale, their daytime sleepiness, snoring score, and RDI with low complication rate. This study has shown that radiofrequency offers the potential of altering the upper airway size in patients with moderate to severe OSA.

Radiofrequency-assisted uvulopalatoplasty (RAUP) is similar LAUP, but it is done with a radiofrequency instrument, instead of a laser. A special radiofrequency electrode is used to make two vertical cuts on either side of the uvula. These are joined by a horizontal cut and the uvula is removed. Most patients are able to return to work the next day. Wedman and Miljeteig[17] performed RAUP as a treatment for social snoring in 40 male social snorers and followed up until 3 months postoperatively. Snoring sounds and daytime tiredness reduced significantly. The relative small investment needed and its simplicity makes RAUP a good alternative to known treatment strategies.

The Coblation method replaces the extreme heat of laser and standard electrosurgery with a gentle heating of the tissues, causing physical reduction and shrinkage of the affected site. This is achieved by molecular disintegration via a plasma-mediated cold ablative process compared to the gradual and slow vascular degeneration produced by radiofrequency procedures. Thus, Coblation results in rapid and precise volumetric tissue removal with little or no collateral tissue damges. In addition, it can simultaneously achieve coagulation of smaller blood vessels within few seconds rather than several minutes with a delayed response like radiofrequency. Its efficacy in volumetric tissue removal has been clearly demonstrated in tonsillectomy[18] and inferior turbinate reduction procedure.[19]

Patients with OSA are more likely to be obese, have hypertension and other cardiovascular disease, and have difficult airways both at intubation and after surgery. The care of these patients requires vigilance to minimize postoperative edema and prevent airway compromise and other complications. If patients undergo surgery under general anesthesia, they should be closely monitored postoperatively in an intensive care unit setting by experienced staff. Since postoperative airway problems usually occur in patients underwent combined multiple simultaneous surgeries, stage procedures are encouraged to avoid this potential complication. Intravenous corticosteroid can be given to reduce swelling or edema of the airway. It should be noted that apnea is aggravated by narcotics, and life-thereatening loss of airway can be precipitated. Thus, antiemetics, sleeping medications, relaxants, and sedative tranquilizers should be avoided. The criteria for discharge include a secure airway, adequate intake of fluids, and pain control from oral medications.

If all treatment modalities fail, tracheostomy can be considered as a final

therapeutic option, especially in morbidly obese patients with severe OSA, significant oxygen desaturation, and/ or associated cardiac disease.

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