The role of anterior palatoplasty for treatment of snoring and obstructive sleep apnea

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Objective: The objective of this study was to evaluate the effectiveness of anterior palatoplasty in treatment of patients with snoring and mild to moderate obstructive sleep apnea (OSA).

Material and Methods: The study included 12 patients suffering from snoring and mild to moderate obstructive sleep apnea for whom all anterior palatoplasty was performed. Epworth sleepiness scale (ESS), flexible nasopharyngoscopy and polysomnography (PSG) were performed for all patients pre and post operatively and the results were analyzed to evaluate the effectiveness of the technique in treatment of the patients.

Results: The mean pre operative ESS significantly improved from 13.25 to 6.25 post operatively (P=0.000), the mean apnea hypopnea index (AHI) significantly decreased from 16.62 to 5.21(P=0.000), the mean lowest oxygen saturation (LOS) significantly improved from 78.92% to 88.83% (P=0.019) and the success rate was 91.7%.

Conclusion: The anterior palatoplasty is effective in treating patients with snoring and mild to moderate OSA as it produces subjective and objective improvement in sleep in such patients.

Keywords: Anterior palatoplasty, snoring, obstructive sleep apnea, polysomnography, apnea hypopnea index.

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Introduction

Snoring occurs when oral cavity and oropharyngeal structures vibrate such as the soft palate and uvula, tonsils, pharyngeal muscles and oropharyngeal tongue. Obstructive sleep apnea (OSA) occurs when the airway collapses resulting in absence of air entry and decrease of oxygen saturation and then sleep arousal. OSA is not uncommon as it affects 2% to 4% of adult population. [1] Its severity is classified according to the number of apnea and hypopnea events in one hour sleep (mild if<20, moderate if 20-40, severe if>40).

The commonest surgical procedure used for treating snorers and OSA patients is the uvulopalatopharyngoplasty (UPPP). The technique aims at palatal reduction and includes tonsillectomy, suturing of the anterior and posterior pillars and excision of a small part of the soft palate including the uvula. [2] The draw backs of UPPP included post operative foreign body sensation, globus sensation, discomfort, dry throat, bleeding, scar contracture and the risk of occurrence of velopharyngeal incompetence. [3]

The commonest site for vibration in snorers is the soft palate and for collapse in OSA patients is the retropalatal space. [4] Consequently, most of the surgical techniques used to treat snoring or OSA aimed at creating a scar in the palate with subsequent fibrosis that will cause palatal stiffening. This stiffening will prevent vibration or collapse of the palate. [5]

Ellis in 1994 performed the palatal stiffening operation in which he stripped a small area of mucosa from the uvula and soft palate. [6] In 2000 Mair and Day modified this operation to the cautery assisted palatal stiffening operation (CAPSO) and performed it on 206 patients reporting a 77% success rate of snoring reduction. [7]

Pang and Terris described the modified CAPSO technique which gave good results in patients with snoring and mild OSA. [8] The modified CAPSO technique was later renamed as the anterior palatoplasty as it actually involves the anterior surface of the soft palate rather than being a modification of the CAPSO technique. This technique is done either under local anesthesia if the tonsils are absent or small or under general anesthesia if the tonsils are large requiring tonsillectomy. The technique involves excision of the uvula using diathermy, performing two vertical cuts in the soft palate on either side of the uvula and removal of a rectangular mucosal strip from the soft palate (50 mm in length and 10 mm in width). The edges of the stripped area are then sutured with vicryl sutures transposing the soft palate anteriorly and superiorly. This technique avoids the commonly known draw backs of UPPP. [5]

We used this technique performing only the mucosal stripping with suturing of the stripped area with or without tonsillectomy under general anesthesia in patients with snoring and mild-moderate OSA. By doing so, we aimed to be less invasive resecting lesser amount of soft tissue and thus decreasing the incidence of post operative complications, post operative pain intensity and duration. Our goal was to evaluate the effectiveness of this technique in treatment of patients with snoring and mild-moderate OSA.

Material and Methods

This study included 12 patients suffering from excessive day time sleepiness or snoring. Patients were selected from those attending the outpatient clinic of the otolaryngology department of Kasr El Aini university hospital during the period from Feb 2018 till July 2018. We obtained approval from the ethical committee of our department and all

patients signed a consent before participating in the study. All patients underwent surgical intervention in the form of anterior palatoplasty for the treatment of snoring and obstructive sleep apnea. The study aimed to evaluate the effectiveness of this technique in treating such patients by comparing pre and post-surgery results by history, physical examination, polysomnography and endoscopy.

The inclusion criteria included: a) patients with age 18 or above, **b)** body mass index (BMI) <33, **c)** patients with snoring or mild to moderate OSA (apnea hypopnea index > 10 and <40), **d)** minimal base of tongue collapse (<25%).
The exclusion criteria included: a) patients below 18 years, **b)** patients with BMI > 33, **c)** patients with severe OSA (AHI>40), **d)** base of tongue collapse>25%, **e)** patients with uncontrolled hypothyroidism, diabetes mellitus or any chronic disease, **f)** patients with gross maxillary or mandibular deformities.

Assessment of patients
All patients included in the study were subjected to the following:

1) Clinical assessment including:
a. Thorough history taking including age, gender, smoking habits, respiratory symptoms such as cough, expectorations, dyspnea and wheeze, history of sleep wake, sleep take morning headaches, daytime hyper somnolence, intellectual deterioration, insomnia, habitual snoring, restless sleep.
b. Epworth Sleepiness Scale (ESS): we used the sleepiness scale used by Berry et el 2013 to measure daytime sleepiness. The score obtained was used to subdivide the patients into mild daytime sleepiness (ESS 11-14), moderate daytime sleepiness (ESS 15-18), and severe daytime sleepiness (ESS > 18).

2) Physical assessment including:
a. ENT examination:
- Nasal examination: detection of nasal polpi, deviated septum or hypertrophied inferior turbinate.
- Oropharyngeal examination: size of tongue, long uvula, high arched palate, tonsil size and Mallampati classification.

b. General examination:
- Anthropometric measurements: body weight (kg.), body height (cm.) neck, circumference.
- Body mass index (BMI): obtained by dividing weight (kg) by the square of the height (m2).

c. Flexible nasopharyngoscopy: We examined the nose pharynx and larynx. Pharyngeal collapse was assessed by the Muller maneuver. This maneuver is done by asking the patient to breathe with the lips closed and the examiner closing the nose with his fingers. This creates a negative pressure in the pharynx and evaluation of the retropalatal, retroglossal, and retroepiglottic spaces is possible. We examine the base of the tongue by asking the patient to extend his tongue. Flexible laryngoscopy determines the site and degree of collapse.

3) Investigations including: Chest X-ray, ECG, ABG to exclude pulmonary, cardiac or chest cage abnormalities.

4) Polysomnography (PSG): 16 channels with standardized polysomnographic techniques that included monitoring of the electroencephalogram (EEG) , electrooculography (EOG), submental electromyography (EMG), electrocardiography (ECG), flow (thermistor), respiratory and abdominal effort, leg movements. body position. In addition, quantitative snoring intensity with a microphone was placed over the patient's trachea, and arterial oxygen saturation levels were continuously recorded with an oxygen saturation sensor placed on the fifth finger of each subject, and data were recorded on computer. It detects presence, type and severity of apnea. Accordingly patients with OSA are subdivided into mild if AHI < 10, moderate if AHI 20 – 40, severe if AHI > 40.

Surgical procedure:
We performed a modification of the anterior palatoplasty technique by performing only stripping of the small rectangular area of mucosa from over the soft palate. The procedure was done under general anesthesia. A horizontal rectangular strip of mucosa was removed from the soft palate down to the muscular layer. The stripped area was sutured with a Vicryl 3/0 round body-curved needle. Tonsillectomy was first performed if the patient had relatively large tonsils. **Figs. (1-3)**.


Fig 1 Horizontal rectangular strip of mucosa removed

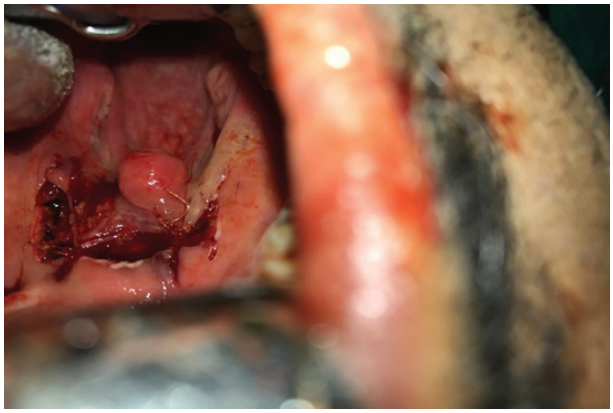
Fig 2 Suturing the stripped area


Fig 3 Final view of anterior palatoplasty

Post operative management:
Pain control was achieved by giving all patients analgesigs and non-steroidal anti-inflamatory drugs. All patients were discharged on the next day to surgery and they were advised to have a soft blended diet in the first postoperative week.

Follow up:
The follow up period ranged from 3 to 6 months, follow up consisted of history taking physical examination of the patients, in addition to Epworth sleepiness scale, polysomnography and flexible nasopharyngoscopy postoperatively.

Statistical analysis:
Data were statistically described in terms of mean ± standard deviation (±SD), and range. Comparison between pre-and post-operative values was done using paired t test. P values less than 0.05 was considered statistically significant. All statistical calculations were done using computer program IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA) release 22 for Microsoft Window.

Results
The total number of patients included in the study was 12 patients, 8 males (67%) and 4 females (33%). Age of the patients ranged from 32 to 65 years with a mean age of 48 years. The weight of the patients ranged from 65 to 92 Kg with a mean weight of 80.95 Kg. The BMI of all patients ranged from 25 to 34 with a mean of 29.33.

The mean pre operative ESS significantly improved from 13.25 to 6.25 post operatively (P=0.000). The mean AHI significantly decreased from 16.62 to 5.21(P=0.000). The mean lowest oxygen saturation significantly improved from 78.92% to 88.83% (P=0.019). The success rate was 91.7 % defining the success rate as 50 % reduction of the pre operative AHI and an AHI<20. **(Tables 1,2)**.

There were no complications from this procedure (primary or secondary hemorrhage, fistula of the soft palate, permanent palatal incompetence).

Table 1 Descriptive statistics of all 12 patients

	N	Minimum	Maximum	Mean	Std. Deviation
Age	12	32	65	48	10.63
ESS pre	12	11	14	13.25	1.14
ESS post	12	6	7	6.25	0.45
BMI	12	25	34	29.33	2.99
AHI pre	12	9.6	32	19.62	7.66
AHI post	12	2	7	5.21	1.63
LSAT pre	12	49	89	78.92	12.92
LSAT post	12	88%	90%	88.83%	0.72%

ESS pre: Epworth sleepiness scale pre operative, **ESS post:** Epworth sleepiness scale post operative, **BMI:** body mass index, **AHI pre:** apnea hypopnea index pre operative, **AHI post:** apnea hypopnea index post operative, **LSAT pre:** lowest oxygen saturation pre operative, **LSAT post:** lowest oxygen saturation post operative, **Std Deviation:** standard deviation.

Table 2 Paired samples tests

		Paired Differences					T	df	P value
		Mean	Std. Deviation	Std. Error Mean	95% CI of the difference				
					Upper	Lower			
Pair 1	ESS pre-ESS post	7	1.044	0.302	6.33	7.66	23.21	11	0.000
Pair 2	AHI pre-AHI post	14.4	6.84	1.97	10.05	18.75	7.29	11	0.000
Pair 3	LSAT pre-LSAT post	-9.91	12.47	3.6	-17.84	-1.99	-2.75	11	0.019

ESS pre: Epworth sleepiness scale pre operative, **ESS post:** Epworth sleepiness scale post operative, **BMI:** body mass index, **AHI pre:** apnea hypopnea index pre operative, **AHI post:** apnea hypopnea index post operative, **LSAT pre:** lowest oxygen saturation pre operative, **LSAT post:** lowest oxygen saturation post operative, **Std Deviation:** standard deviation.

Discussion
The most commonly applied techniques for the treatment of patients suffering from snoring or OSA are the UPPP and the laser assisted uvulopalatoplasty (LAUP) both of which aim at reduction of the palatal tissues. Both procedures are well known with their post operative discomfort, dry throat, severe pain and high incidence of complications. Furthermore, recent reviews have shown that UPPP does not really improve the AHI in patients with moderate to severe OSA and LAUP is not recommended for all grades of OSA. [9-11]

In a study done by Mair and Day on 206 patients suffering from snoring for whom they performed CAPSO they achieved a 77% success rate in snoring reduction. [7] Pang and Terris modified this technique to the modified CAPSO technique and achieved very good results on a small group of patients suffering from snoring and mild OSA. [8] They combined the laser assisted uvulopalatoplasty technique with stripping of a small area of mucosa from over the soft palate followed

by suturing of this stripped area. [12] This technique pulls the soft palate anteriorly and superiorly thus widening the retropalatal space and preventing palatal collapse. The technique is easy, quick, uncosty, can be done under local anesthesia, is anatomically logic as it causes scaring superiorly and anteriorly, has a low rate of complications compared to the palatal advancement operation which requires bone drilling and hard palate resection [13] and avoids the disadvantages of UPPP. This technique has been later renamed as the anterior palatoplasty technique.

We modified this technique performing it partially. We only stripped the mucosa followed by suturing of the stripped area with or without tonsillectomy under general anesthesia. We did so in order to remove lesser amount of soft tissue and thus decreasing the incidence of post operative complications, post operative pain intensity and duration.

Evidence based medicine in the form of meta-analysis revealed that anterior palatoplasty or its variants showing equality or even superiorty in comparison to UPPP. [14] In meta-analysis including six studies, [15-20] anterior palatoplasty reduced the mean AHI from 16.3 to 7.1, the mean snore visual analogue scale improved from 7.5 to 3.1 and the mean Epworth score improved from 11.3 to 7.3 postoperatively. Mean pre operative lowest oxygen saturation increased from 84.5 % to 92 % post operatively. The overall success rate reported was 72.5 % with a mean follow up of 17.3 months, defining the success rate as 50 % reduction of the pre operative AHI and an AHI < 20. These results showed that anterior palatoplasty although less aggressive in term of airway widening achieved equally good results in comparison with other aggressive manouveres like UPPP and uvulopalatal flap. [18,19]

Similarly in our study the mean pre operative ESS significantly improved from 13.25 to 6.25 post operatively (P=0.000), the mean AHI significantly decreased from 16.62 to 5.21 (P=0.000), the mean lowest oxygen saturation significantly improved from 78.92% to 88.83% (P=0.019) and the success rate was 91.7%. This high success rate may be due to the relatively small sample size, and our selection of mild to moderate OSA patients.

One of the studies done by Pang et al in 2009 on 38 patients suffering from snoring and 39 patients suffering from OSA, they found that in the OSA group the AHI improved from 25.3±12.6 to 11.0±9.9 (P<0.05), the lowest oxygen saturation improved from 81.4±19.2 to 92.0±16.9 (P<0.05) and the success rate was 71.8 % with a mean follow up of 33.5 months. The mean visual analogue score improved from 8.4 to 2.5, the ESS improved from 16.2 to 7.9 and there were no complications for all the 77 patients post operatively. [16] Similarly in our study we did not experience any post operative complications.

Regarding the two studies that compared the anterior palatoplasty technique with other techniques, Marzetti et al compared it with the uvulopalatal flap technique and they found that the ESS and AHI had significantly improved in the anterior palatoplasty group compared to the uvulopalatal group (P<0.05) and that the pain duration (7 days) and intensity (score of 5.1) were lower in the anterior palatoplasty group than the uvulopalatal group (10.8 days, score of 6.8). [18] Uger et al compared the same technique with the modified uvulopalatopharyngoplasty technique showing similar results with much more improvement regarding ESS and snoring reduction and much higher satisfaction rate in the anterior palatoplasty group compared to the modified uvuloplatopharyngoplasty group. [19]

Similarly in our study the pain duration was around 7 days and the pain intensity was moderate and got relieved by simple analgesics. The authors there found that their simple less invasive technique did not affect the effectiveness of the anterior palatoplasty procedure. This was evident in the equality of our results in comparison with more invasive variants of the anterior palatoplasty procedure as well as other variants of UPPP. In the era of minimally invasive surgery it is worthwhile to acquire the least invasive surgical technique provided having equal success rates.

Conclusion

The anterior palatoplasty is useful and effective in patients with mild and moderate OSA. This procedure is simple to perform, has promising results, has minimal complications and produces subjective and objective improvement in sleep in OSA patients. Additional research should be done to examine the long-term effects of anterior palatoplasty surgery in larger sample of patients.

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