Palatoplasty versus radiofrequncy palatal surgery for management of obstructive sleep apnea

Osama A Elsayad[1*], Mohamed Sabri[2]
[1] Department of Otolaryngology, Benha University, Benha, Egypt
[2] Maxillofacial department, Saudi German Hospital Jeddah, KSA

Abstract

Background: Obstructive sleep apnea (OSA) is a huge problem affecting large sector of people all over the world with great social and physiological effects. The aim of this study is to investigate the effect of radio frequency palatal. Surgery and palatoplasty in treatment of obstructive sleep apnea OSA.

Patients and Methods: This study included 70 patients with mild to moderate OSA Group A: n=35 (Tonsillectomy and palatal radio frequency surgery) and Group B n=35 (Tonsillectomy and palatoplasty), this study investigate the effect of radio frequncy technique and palatoplasty on retropalatal anteroposterior diameter, Epworth Steepness Scale, apnea Hypopnia Index in
Treatment of OSA.

Results: This study found that both techniques improved day time sleepiness with reduction of apnea- hypopnea index (AHI), also there was marked improvement in radiological parameters in the form of increase of the anteroposterior diameter and retro-palatal cross section area, in postoperative in both groups but there was superiority of group A over group B in improvement of this parameters, group A success rate was 81.3% and Group B was 78.6%

Conclusion: radio frequency palatal surgery and palatoplasty both are effective as a treatment of obstructive sleep apnea due to retro-palatal collapse.

Keywords: Radio frquency, palatoplasty, obstructive sleep apnea, apnea hypopnea index

Introduction

Snoring is a common problem affecting almost half of males and a third of females between 35 and 60 years of age, It results from increased upper airway resistance and soft palate collapse during sleep which may lead to obstructive sleep apnea (OSA),obstructive sleep apnea (OSA) is presented by pharyngeal collapse during sleep, Pharyngeal collapse can occur at the retropalatal level (soft palate), retroglossal level (tongue base), oropharyngeal lateral walls, and/or hypopharynx, treatment of OSA include weight loss, smoking/alcohol stoppage, positional therapy, and oropharyngeal exercises. Mandibular advancement devices, nasal devices, and continuous positive airway pressure (CPAP) are other mechanical alternatives [1].

Radio frquency ablation (RFA) is effective in treatment of OSA, the mechanism of action for RFA is due to a low temperature, high frequency current leads to local inflammation, fibrosis and stiffening of the tissue. RFA of the soft palate is minimally invasive, with few complications, and aims to stiffen the soft palate [2].

Palatoplasty and radiofrequency ablation (RFA) to decrease snoring and correct sleep apnea, by using RFA of the midline muscular palate initially described by Powell *et al*.3 and others4 which although reduces snoring with low serious adverse effects, requires multiple treatments with variable outcomes [3].

All Surgical treatment for snoring and obstructive sleep apnea used to increase the upper airway cross-sectional area, remove obstructive tissues, such as tonsils, other surgical techniques include inferior sagittal mandibular osteotomy and genioglossus advancement with hyoid myotome and Suspension, laser midline glossectomy and palatal implants, nasal surgery [4].

The present study aimed to investigate the effect of palatal Radio frquency technique and palatoplasty as a treatment of mild and moderate obstructive sleep apnea.

Patients and Methods

This study is a prospective randomized case series clinical study. The study was conducted on Otorhinolaryngology clinics of Saudi German Hospital Jeddah during the period from February 2019 till march 2020.This study included 70 patients with mild to moderate OSA were divided into two groups

The study was approved by the local ethics committee of Saudi German Hospital in Jeddah according Saudi health regulations, all patients in this study have oral and written consent.

Inclusion criteria
- Both sexes, diagnosed with OSA with retropalatal collapse, with tonsils size grade I-II-III
- Patients> 18 years old, and < 60 year with Body mass less than 35\Kg\m2, with history of failure or refusal of non-surgical measures

Exclusion criteria
- Patient age<18 or >60 years old, severe deviated septum and huge concha
- Modified Mallampati classification: class IV tongue position with deformity of maxilla or mandible
- Patient with central sleep apnea.
- Can't do postoperative follow-up polysomnography
- Previous surgical treatment of OSA or class II type occlusion

Patients and methods
70 patients complaining of OSA (mild to moderate) degree, due to retropalatal collapse. patients were randomly allocated into two groups:
Group A: tonsillectomy with palatal radiofrequency technique
Group B: tonsillectomy with palatoplasty.

Preoperative evaluation
- Full detailed history with clinical examination
- Endoscopic examination: By Awake Fiberoptic Nasopharyngoscopy with Müller's maneuver:
- Epworth Sleepiness Scale.
- Polysomnography (PSG) test
- Radiological examination, by Volumetric CT for the upper airway to evaluate the retropalatal space:
- Other preoperative laboratory investigations, chest X-ray

Operative procedures
- The procedures were done by same surgeon.
- All procedures done under general anesthesia with transoral endotracheal intubation

Group A: palatal radio frequency technique shown in figure (1)
- Tonsillectomy by cold dissection
- The procedure was performed in the operating room under general anesthesia. The Coblation radio frequency device was set to 60 °C,

The probe was passed in the midline and 1 cm into the paramedian locations bilaterally, Coblation which is a registered trade mark on Anthro Care corporation Sunnyvale CA, USA. The patient discharge with medication diclofenac potassium 50 mg, then seen one week following surgery, most of patients doing well without fever, pain, or complication [7].
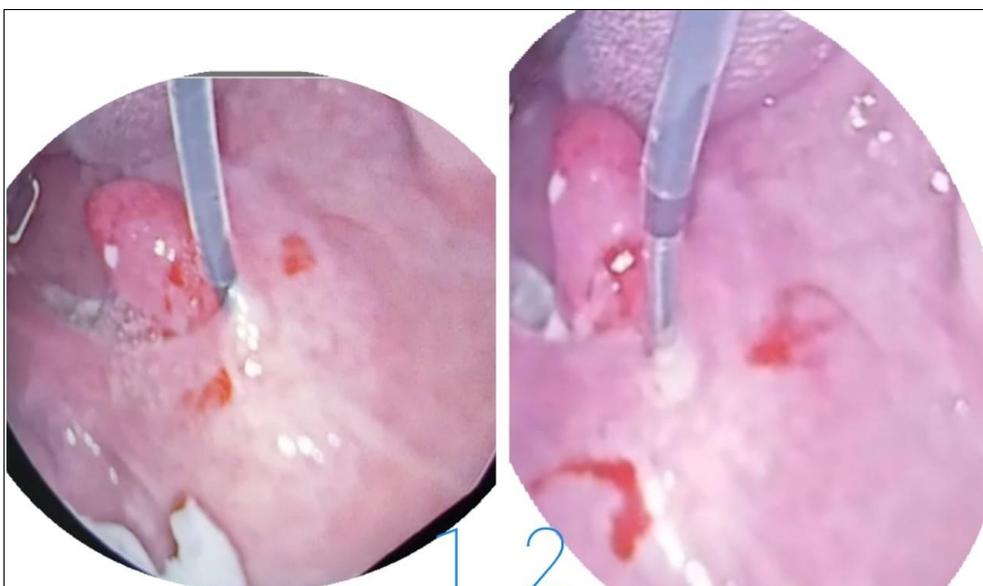(Group A: Fig 1) Palatal radio frequency technique

Fig 1: Palatal Radio frequency technique

Group B: Palatoplasty: As shown in figure (2)
- Tonsillectomy by cold dissection
- Injection of 10 cc saline with 1:1000 adrenaline into area 1cmX4cm at the base of uvula in the soft palate, then a horizontal rectangular strip of mucosa was removed from the soft palate by 15 scalpel, then inverted sutures with Vicryl 4/0 round body curved needle start from upper edge to Lowe edge including mucosa and palatal muscles, A minimum of 8 to 10 sutures are used was achieved with electrocautery to control bleeding, All patients were prescribed non-steroidal anti-inflammatory agents (diclofenac potassium 50 mg), patient was seen one week following surgery and was doing well without fever, pain, or complication
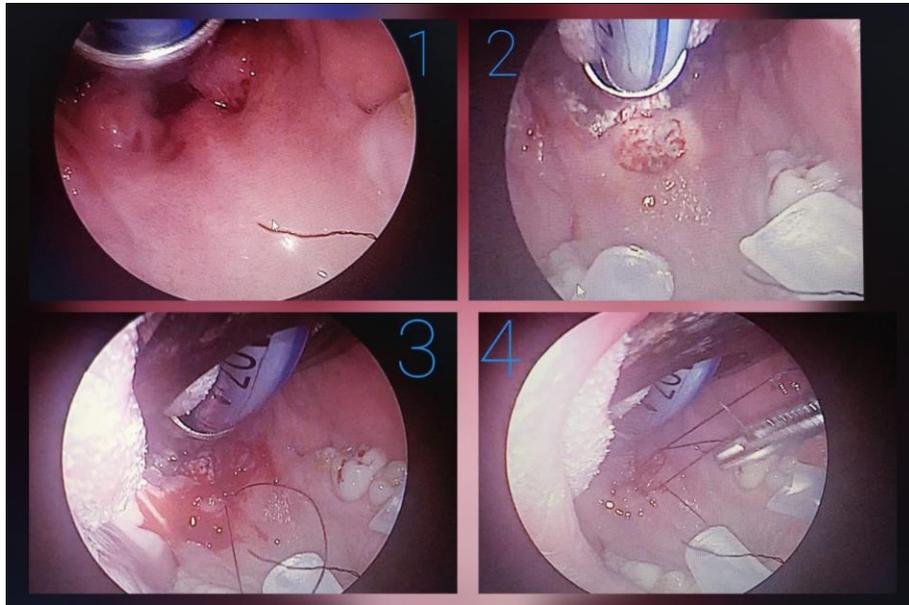

Fig 2: Palatoplasty technique

Postoperative Evaluation
Follow-up visits were scheduled at 1, 2, 3 weeks, and 3 months postoperative.

Epworth sleepiness scale (ESS)
Daytime sleepiness Assessment Snoring loudness and ESS score were assessed at baseline, 3 months after surgery, the AHI between baseline and 3 months postoperative [8].

Polysomnography (PSG)
Polysomnography was done at baseline and after 3 months postoperative, the success rate was considered when there is 50% reduction of preoperative AHI index [9].

Awake Fiberoptic Nasopharyngoscopy with Müller's maneuver
Locate the site of collapse at baseline and 3 months postoperative months [10].

Radiologic investigations: volumetric CT were done at baseline and 3 months postoperatively
Postoperative complication include infection, bleeding, throat pain, and velopharyngeal insufficiency

Statistical analysis
The results of this study clinical data were presented in as number and percent or mean and standard deviation, data were tabulated and analyzed using the computer program SPSS (Statistical package for social science) version 25 to obtain descriptive data. It was compared using t test while categorial data were compared using Chi square test, p value less than 0.05 was considered statistically significant [11].

Result
The present study included 70 patients with obstructive sleep apnea,39 male and 31female with age range from 22-53 years, they included two groups: Group A=35 was subjected to tonsillectomy and palatal radio frequency and group B =35 was subjected to tonsillectomy and palatoplasty, both groups were matched regarding age and sex distribution (table 1).
The comparison between both groups according to Epworth Sleepiness scale the mean decrease in group A was pre-operative 12.13 while it was 5.87 post-operative which is significant difference p value p ≤ 0.05, also the mean in group B was pre-operative 10.53 while it was 5.67 post-operative which is significant difference
p value ≤ 0.05 (table 2)

The comparison between the two studied groups according to decrease in Apnea- Hypopnea Index (AHI). The mean decrease in AHI of group A was (5.91 ± 2.50). While it was (5.47 ±1.77) in group B which is not a significant difference (P-Value 0.713) (table 3). Also according to Increase in Antro-Posterior diameter (A-P) (mm). The mean increase in A-P diameter (mm) of group A was (2.64 mm ± 1.57 mm). While it was (1.67 mm ± 1.0 mm) in group B which is not a significant difference (P-Value 0.106) (table 4)

The Comparison between both groups according to degree of collapse in retropalatal area during Muller maneuver; there was considerable improvement in degree of collapse in retropalatal area: In group A it was 86.7% while became 80.0 % in group B which was not a significant difference between both groups (P-Value0.592) (figure 3), Also as Regards the site of collapse in retropalatal area during Muller maneuver: in group A; improvement with no detected site of collapse in 79.2% while it is 67.5 % in group B, which is not a significant difference between both groups (P-Value0.592) (figure 4)

The results of both groups included Success rate which equal cured cases plus success cases, In Group A: success rate was 81.3% while 78.6% in Group B: which is not a significant difference between both groups; P-Value:1.000 Cure rate: AHI: post < 5 and ESS post< 10 and reduction of both of them > 50%,

Success rate: AHI post< 15 and ESS post< 10 and reduction of both of them > 50% Failure rate: AHI post ≥ 30 or ESS post ≥ 10 or reduction of both of them ≤ 50% (table 5)

Table 1: Comparison between the two studied groups according to demographic data

Gender	Group A (N =35)		Group B (N =35)		Test of Sig.	p
	No.	%	No.	%		
Male	18	51	17	49	$\chi 2= 0.136$	0.618
Female	17	49	18	51		
Age (years)						
Min. – Max.	22.0 – 53.0		21.0 – 42.0			
Mean ± SD.	35.93 ± 9.0		32.80 ± 5.97		t= 1.124	0.2619
Median (IQR)	35.0 (31.0 – 40.50)		33.0 (29.50 – 37.0)			

p: p value for comparing between the studied groups, significant if >0.05.

Table 2: Comparison between the two studied groups according to change in ESS

ESS	A			B			P
	Preop	Postop	P	Preop	Postop	P	
Range	8.0 – 17.0	3.0 – 13.0	0.001*	5.0 – 17.0	2.0 – 14.0	0.001*	0.089
Mean ± SD.	12.13 ± 2.77	5.87)± 3.16		10.53 ± 3.93	5.67 ± 3.73		
Median (IQR)	11.0 (10.0 –14.0)	5.0 (3.50–7.0)		9.0 (7.50 – 14.50)	4.0 (3.0 –7.0)		

p: p value for comparing between pre and post*: Statistically significant at p ≤ 0.05 ESS: Epworth Sleepiness Scale

Table 3: Comparison between both studied groups according to score of AHI

AHI	A			B			P
	Preop	Postop	P	Preop	Postop	P	
Range	7.0 – 22.0	3.0 – 16.0		8.0 – 20.0	4.0 – 15.1		
Mean ± SD.	13.53 ± 5.32	7.62 ± 4.32		12.93 ± 3.97	7.47 ± 3.60	0.001*	0.713
Median (IQR)	11.0 (9.0 – 17.50)	6.0 (4.15 – 10.0)	0.001*	12.0 (10.0 – 15.50)	6.0 (5.0 – 8.50)		

p: p value for comparing between pre and post*: Statistically significant at p ≤ 0.05 AHI: Apnea-Hypopnea Index

Table 4: Comparison between both studied groups according to change of A-P diameter (mm)

| A-P diameter (mm)	A			B			U	P
	Preop	Postop	P	Preop	Postop	P		
				2.50 – 10.0	2.70 – 11.21			
Range	3.10 – 10.0	3.20 – 11.40						
			0.001*			0.001*		
				6.59 ± 2.25	8.26 ± 2.71			
Mean ± SD.	6.59 ± 2.15	9.23 ± 2.54					73.50	0.106
				6.30 (5.50 – 8.45)	8.50 (8.15 – 10.0)			
Median (IQR)	6.20 (5.30 – 8.20)	9.80 (9.0 – 11.0)						

p: p value for comparing between pre and post*: Statistically significant at p ≤ 0.05 A-P diameter: Antro-posterior diameter of retropalatal (RP) area

Table 5: Comparison between both studied groups according to outcome

Outcome	Group A (n = 35)		Group B (n = 35)		χ^2
	No.	%	No.	%	
Success	19	54.2	18	51.4	
Cure	12	34.3	11	31.4	0.435
Fail	4	11.5	6	17.2	

Chi square test
p: p value for comparing between the studied groups *: Statistically significant at p ≤ 0.05
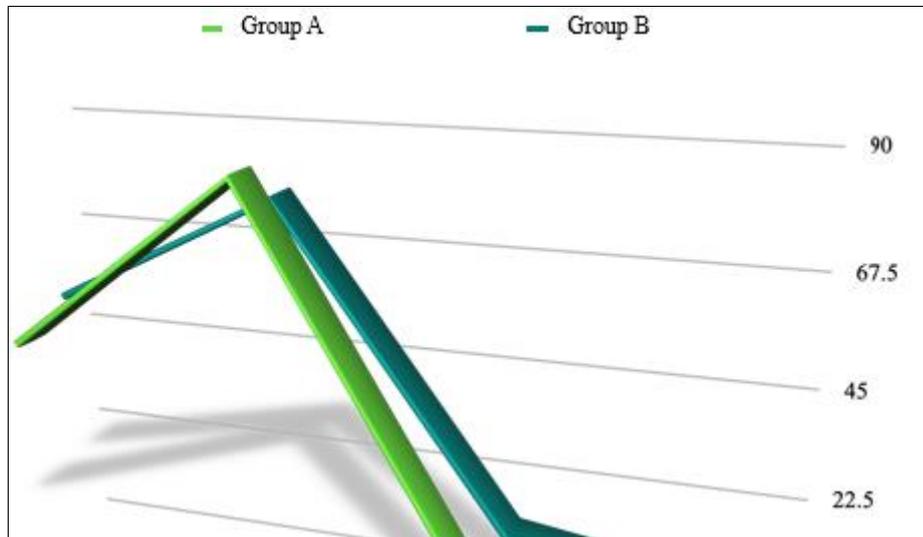
Fig 3: Comparison between both groups according to Degree of collapse in retropalatal area during muller maneuver
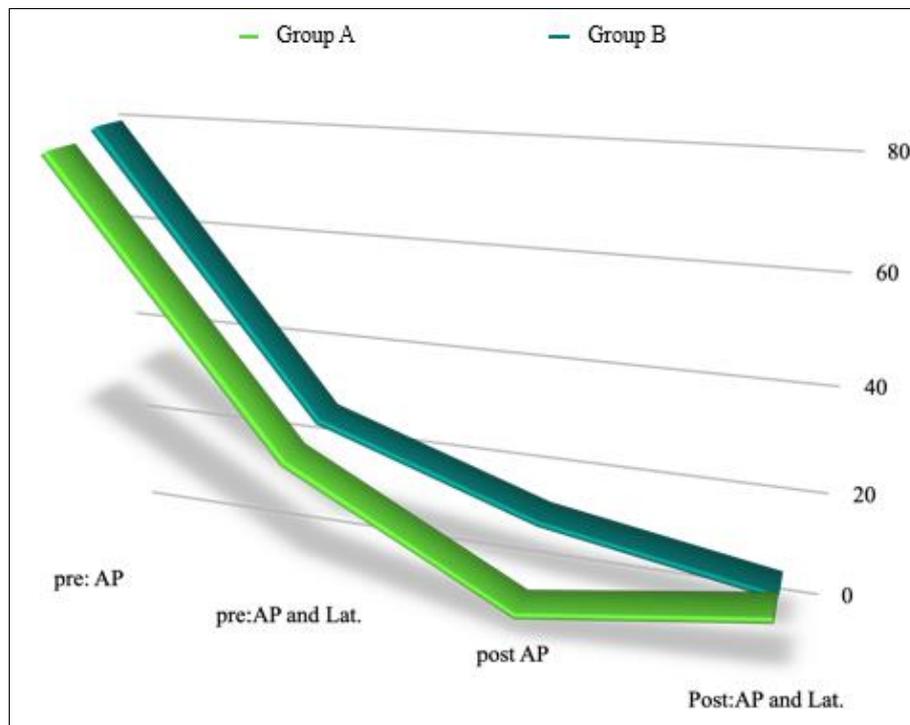
Fig 4: Comparison between both groups according to Site of collapse in retropalatal area during muller maneuver,AP: antro posterior diameter, Lat: lateral collapse

Discussion
Sleep surgery expands with new procedures depends on the dynamic upper
airway thorough understanding of the fundamental principles of the surgery, palatal surgeries focused on the lateral pharyngeal wall collapse, it varies from lateral, anterior palatoplasty, pharyngoplasty, Barbed Reposition Pharyngoplasty and radiofrequency palatal surgery [12].
The results of the present study showed the effect of palatal stiffening using palatoplasty and palatal radiofrequency surgery to determine the short-term results of the two procedures in the elimination of sleep

apnea, this work has a clinical application of palatoplasty and palatal radiofrequency technique in management of obstructive apnea due to retropalatal collapse for stiffening of the soft palate with preservation of soft palate horizontal part and vertical part, this agree with Randerath *et al.*, who concluded that stiffening of soft palate is important in correction of snoring and sleep apnea [13].

The hypothesis of this procedure is preservation of soft tissue based on non- resective techniques, with good functional outcomes in OSA patients with single-level collapse(retropalatal collapse) and also increase of retropalatal antropostrior diameter which was significant in both groups which agree with Cho *et al.*, who concluded same results [14] moreover our study reported that day time sleep ness was improved also AHI is corrected by both techniques which agree with Sinkkonen *et al.*, who concluded that radiofrequency palatal surgery is useful in improving the AHI in sleep apnea.(15)

The radiological parameters showed reduction in antro posterior diameter of retro pharyngeal area after palatoplasty and palatal radio frequency techniques in short term results with preservation of soft palate horizontal part and vertical part

Findings of the present study may have significant clinical implication particularly in Epworth Steepness scale in both techniques which agree with Thorbjorn *et al.*, who proved that radio frequency and stiffening of soft palatal improved sleepless scale and day time sleepless [16].

Group A was superior over group B in improvement of all parameters, that In Group A: success rate was 81.3% while in Group B was 78.6%., there was no postoperative complications like severe bleeding with surgical intervention, edema which needs tracheotomy, or infection. But minor complications were recorded, mainly dysphagia and pain that improved soon.

Conclusion
Palatoplasty and palatal radio frequency technique, both are effective as a treatment of obstructive sleep apnea due to retropalatal collapse.

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Author contribution
Authors contributed equally in the study.

Conflicts of interest
No conflicts of interest

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