

Original Article

Efficacy of Zeta palatopharyngoplasty in the management of obstructive sleep apnea

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Abstract:

Background: Due to obstructive sleep apnea (OSA), cardiovascular system and brain are affected resulting in OSA syndrome. Daytime sleepiness is seen in 80% cases. This can affect their work, quality of life and can be lead to accidents. It may also affect cognition, concentration, memory, and mood and can lead to neurobehavioral dysfunction, depression and irritability.

Objective: To study the efficacy of zeta palatopharyngoplasty in the management of obstructive sleep apnea

Methods: Hospital based prospective study was carried out among 30 cases of OSA. All cases were surgically managed using the Zeta palatopharyngoplasty. The outcome of surgery including complications was studied.

Results: Mean age was 45.1 years. Most of them belonged to 4th-5th decade. 26 (87%) were males. All subjective symptoms were relieved 100% postoperatively except day time fatigue which persisted in 30%. Polysomnography parameter of AHI showed success of surgical procedure. Postoperative respiratory distress index values predominantly belonged to category of 5-14 in 86% showing an improvement of 80.77% on average. Postoperatively oxygen saturation values improved drastically mostly falling in normal range of 80-90 seen in 60% and >90 seen in 30% with an improvement of 22.1% on average. Total snoring events showed an improvement of 88.9%. Postoperative FLP findings showed relief from these blocks as patients have undergone tailored multilevel surgical corrections. All were free from complications by six months. In categorization of OSA more number of patients was categorized as severe in 53.3% preoperatively. Postoperatively 11 (36.3%) have become normal and 19 (63.3%) have come down to mild category.

Conclusion: The Zeta palatopharyngoplasty has been found to be effective in the management of patients with OSA.

Key words: Zeta palatopharyngoplasty, management, obstructive sleep apnea

Introduction:

It has been estimated that Obstructive sleep apnoea (OSA) affects about 2-4% of adults. Middle aged men are most commonly affected. ¹ During sleep, there is partial or complete

collapse of the upper airway. These episodes are repeated. The collapse leads to reduced airflow and there is asphyxia which is progressive in nature. Due to this, the person has to put extra efforts for breathing till he is awake.²

The respiratory sleep is monitored in the night along with nocturnal cardio-respiratory polygraphy or Polysomnography for the diagnosis of OSA which is directed to find out the obstructive events. This is correlated with the oxygen saturation in the blood. The severity of the OSA is based on the apnoea/hypopnoea index (AHI). It takes into account the total obstructive events every hour. Nocturnal cardio respiratory monitoring is used to obtain AHI.³

The OSA is multi-factorial in causation including genetic factors, anatomical factors, neuromuscular factors etc. Risk factors include preponderance towards males and post menopausal women, history of snoring, large neck circumference and middle age. Due to OSA, the cardiovascular system and brain are affected and even the metabolic balance can be affected. The result is the OSA syndrome. Daytime sleepiness is seen in about 80% of the cases. This can affect their work, quality of life and can be a reason for accidents.² It may also affect the cognition, concentration, memory, and mood and can lead to neurobehavioral dysfunction, depression and irritability.⁴

OSA can be managed either conservatively or surgically. The options for conservative management are loss of weight, using some oral appliances, certain medications, position therapy, continuous positive airway pressure (CPAP). But problem with CPAP is that most of the cases are not able to withstand it. They require some other option.⁵ Surgery is the treatment of choice if the conservative treatment fails. It is directed towards reducing the obstruction of the airway. It can be done in single sitting or in different stages depending upon the patient condition. Oropharyngeal region is the most common site of obstruction. In these cases there is collapse of the lateral pharyngeal wall. Nowadays, the lateral pharyngoplasty is preferred over the uvulopalatopharyngoplasty (UPPP). So many of them prefer surgical intervention, limited surgery at an early stage of upper airway narrowing might possibly eliminate the self aggravating process of snoring induced upper airway remodelling which finally could develop into OSAS in some patients. Surgical management includes various procedures tailored according to the level of obstruction. Currently, the mainstay of sleep apnea surgery is to achieve less morbidity and high cure rates. Since the introduction of uvulopalatopharyngoplasty, it became the widely used procedure for the treatment of OSA. Success of UPPP is highly dependent on the anatomical relationship between palatal and hypo pharyngeal obstruction. Owing to the limited success rates in curing the obstructive sleep apnea and hypopnea, many adjunctive procedures and modifications were proposed to UPPP. The zetapalatopharyngoplasty (ZPPP) technique was developed as a more aggressive technique for patients with stage II & III disease. ZPPP is the natural association of two established surgical techniques: UPPP & zetaplasty. The goal of ZPPP is to widen the space between the palate and the posterior pharyngeal wall, between the palate and the tongue base and to either maintain or even widen the lateral dimensions of the pharynx. This procedure is performed with adjunctive tongue base reduction by radiofrequency (TBRF), which addresses the hypo pharyngeal airway.^{6,7}

In the present study we used the zeta palatopharyngoplasty (ZPP) in the management of obstructive sleep apnea with the objective to study the efficacy of zeta palatopharyngoplasty in the management of obstructive sleep apnea.

Material and methods:

A hospital based prospective study was carried out over a period of two years from 2021 to 2023 among 30 cases of obstructive sleep apnea. Adults of either gender, having significant symptoms of habitual snoring or excessive daytime somnolence, failure or refusal attempts of CPAP machine, Friedman tongue position II and III tonsils, AHI > 15/HR (PSG finding) i.e. moderate to severe OSA cases and body mass index < 40 kg/m² were included in the present study. Those with morbidity, blood coagulation disorders, suffering from any acute infection, having genetic or craniofacial syndrome or neuromuscular disorders were excluded.

Institutional Ethics Committee permission was obtained. Written informed consent was taken from all eligible participants.

Surgical treatment of OSA addresses nose, nasopharynx, oropharynx, hypopharynx and was tailored specifically to each patient, because the level of obstruction and anatomy are different in each patient. All patients in this study had levels I, II and III blocks so along with ZPP, we combined nasal and radiofrequency tongue base surgery in the same sitting for all the patients. Among the palatal procedures present, we opted for ZPP as the palatal procedure owing to its less complications and high post operative success results both subjectively and objectively. All the patients were advised preoperatively for weight reduction and for a life style modification post surgery for a better outcome.

“Two adjacent flaps were outlined in the palate. The anterior midline margin of the flap is halfway between the hard palate and the free edge of the soft palate and the distal margin corresponds to the free edge of the soft palate and uvula. The lateral extent was posterior to the midline and extends to the lateral extent of the palate. The mucosa from only the anterior aspect of the two flaps was subsequently removed. The two flaps were then separated from each other by splitting the palatal segment down the midline; the uvular flaps along with soft palate are reflected back laterally over the soft palate. By splitting the soft palate and retracting it anterolaterally an effective anterolateral pull was crated, which actually continues to widen the airway as healing and contracture occur. None of the palatal musculature was resected, in spite of the aggressive palatal shortening thereby addressing and minimizing the risk for permanent velopharyngeal insufficiency. This procedure was performed with adjunctive tongue base reduction by radiofrequency, which addresses the hypo pharyngeal airway.”

The data was entered in the Microsoft Excel worksheet and expressed in proportions

Results:

Table 1: Distribution as per age

Age (years)	Numbers	%
20-30	1	3.3
31-40	9	30
41-50	11	36.7
51-60	9	30

The age ranged from 24-60 years with mean of 45.1 years. Most of them belonged to 4th to 5th decade. 26 (87%) were males and 4 (13%) were females (Table 1)

Table 2: Comparison of characteristics pre and postoperative

Characteristics		Pre operative	Postoperative
Symptoms	Excessive day time fatigue	28	0
	Choking spells in sleep	9	0
	Recurrent awakenings	27	0
	Un-refreshing sleep	23	0
	Daytime fatigue	29	9
	Impaired fatigue	20	0
ESS scores	0-8	1	24
	8-24	29	6
AHI/hr	0-14	0	30
	> 14	30	0
respiratory distress index values	0-14	0	30
	> 14	30	0
low oxygen saturation values	Up to 80	27	3
	> 80	3	27
Total snoring events	0 to 1000	0	29
	> 1000	30	01

Most common subjective symptom was day time fatigue, excessive day time sleepiness and recurrent awakenings. All the subjective symptoms were relieved 100% post operatively except day time fatigue which persisted in 9 (30%) of cases. There was on an average 50% improvement in the Epworth sleepiness scale with pre and postoperative values of 13 and 6.5 respectively. Polysomnography parameter of AHI showed values mostly falling in the range of 15-30 / hr in 14 (46%) and > 30/hr in 16 (53%) preoperatively showing increased values. Whereas the postoperative values recorded between 5-14/hr in 20 (66%) cases indicating the success of the surgical procedure. Postoperative respiratory distress index values ranged between 19-77 and of the values fall in the category of > 30 in 17 (56%) cases and 15-30 in 13 (43%) of cases. The postoperative values predominantly belonged to the category of 5-14 in 26 (86%) of cases showing an improvement of 80.77% on average. Preoperative low oxygen saturation values were recorded in 17 (56%) of cases in the range of 71-80 followed by 7 (23%) cases in the range of 61-70. Postoperatively the saturation values improved drastically mostly falling in the normal range of 80-90 seen in 18 (60%) of cases and > 90 seen in 9 (30%) of cases with an improvement of 22.1% on an average. Total snoring events ranged between 1000 to 7000 preoperatively with an average of 3465.03 and postoperative events ranged between 0 to 1400 with an average of 384.2 showing an improvement of 88.9%. (Table 2)

Table 3: Comparison of events pre and postoperative

Events		Preoperative	Postoperative
OSA	0 to 100	16	24
	> 100	14	06

Hypopnea	0-100	24	28
	> 100	06	02
Central apnea	0-100	2	30
	> 100	28	0

The preoperative and postoperative events like OSA, Hypopnea, and central apnea have shown a significant change in their readings. The FLP findings showed level I, II, and III blocks preoperatively indicating that multi level blocks will result in OSA. The postoperative FLP findings showed relief from these blocks as the patients have undergone tailored multilevel surgical corrections. (Table 3)

Table 4: Postoperative complications over six month period

Postoperative complications	15 days	1 month	3 months	6 months
Throat pain	23	5	0	0
Velopharyngeal insufficiency	9	6	0	0
Snoring	16	5	0	0
Voice change	5	10	1	0
Dysphagia	9	4	0	0
Foreign body sensation	19	2	0	0
Taste disturbances	0	1	0	0
Dry throat	16	1	0	0

Throat pain was the most common complaint postoperatively seen in 76.6% of cases during the first 15 days of follow-up which was followed by persistent snoring, nasal blocks, dry throat etc. All the patients were free from complications by the end of three months of follow up except one patient who complained of change in voice. All were free from complications by the end of six months. (Table 4)

Table 5: Changes in the category of OSA from preoperative to postoperative

Category of OSA	Preoperative	Postoperative
Normal	0	11
Mild	0	19
Moderate	10	0
Moderate to severe	4	0
Severe	16	0

In the categorization of OSA more number of patients were categorized as severe in 16 (53.3%), four (13.3%) were categorized as moderately severe, 10 (36.3%) were of moderate category. Postoperatively 11 (36.3%) have become normal and 19 (63.3%) have come down to mild category. (Table 5)

Discussion:

Sleep medicine is perhaps the youngest medical speciality recognized by the American Board of Medical Specialities (ABMS). Obstructive sleep apnea is a part of the spectrum of sleeps disordered breathing (SDB). OSA is characterized by repetitive partial or complete collapse of the upper airway during sleep which results in symptoms. Too narrow upper airway is the

most common cause of SDB. Epidemiologically OSAHS is estimated to affect 2-5% of population. This condition poses a great risk to the patients who suffer from obstructive sleep apnea. It causes various health problems, social problems, decreased efficacy at work, road traffic accidents and financial burden.

Researchers have demonstrated in a cell culture with human bronchial epithelial cells that mechanical vibration stimulated the inflammatory cascade as reflected by increase in interleukin-8. This finding supports the hypothesis that snoring could contribute to airway inflammation in SDB. This inflammation could trigger the histological changes seen in the connective tissue. The amount of loose connective tissue may increase as a result of mechanical trauma caused by snoring and tissue vibrations, negative air pressure during IRR or obstructive periodic breathing in the upper airways. Irrespective of the cause of partial upper airway obstruction during the sleep, edema in the uvulopalatal region might be factor that further aggravates airway narrowing. Limited surgery at an early stage of upper airway narrowing might possibly eliminate the self aggravating process of snoring induced upper airway remodelling, which finally could develop into OSAS in some patients.

Patients with partial upper airway obstruction during sleep present with uvulopalatal edema which is manifested in the uvulopalatal region as loose connective tissue. Although partial upper airway obstruction during sleep also increases with increasing BMI, the loose connective tissue may play a more important role than the soft palate fat accumulation in partial upper airway obstruction during sleep. Velopharyngeal edema may play a role needed for the initiation and aggravation of the upper airway obstruction resulting in symptomatic partial or complete upper airway obstruction during sleep.

For the improvement of the symptoms various treatment modalities are available i.e. behavioural (weight reduction, positional therapies, sleep hygiene) medical and surgical. Surgical correction of the structural upper airway abnormalities was initial and natural approach to treat patients with OSAS and socially disturbing snoring. Nasal CPAP has later become primary treatment, particularly of obese patients with moderate to severe OSAS. CPAP is the mainstream medical management, but due to the less compliance and inconvenience to the patients it is difficult to practice.

In the present study 26 were males and 4 were females with an age ranging between 20-60 years. Mean age was 45.1 years. Most of them belonged to 4th to 5th decade of their life. Similar findings were reported by Ancoli IS et al ⁸, Bixler EO et al ⁹, and Young T et al ¹. These studies state that OSAHS typically presents between the ages of 40-60 and increases with age.

In the present study most of the subjects recorded a drastic improvement in subjective symptoms. The excessive day time sleepiness was completely cured postoperatively whereas it was reported by 28 subjects out of 30 preoperatively. Choking spells which was reported in 9 subjects preoperatively became nil postoperatively. Recurrent awakenings also reported nil postoperatively when compared to its presence in 27 cases. Un-freshening sleep in 23 out of 30 subjects also reported zero postoperatively. Day time fatigue continued in nine subjects postoperatively which was reported in 29 subjects preoperatively. Impaired concentration improved 100% as it was nil postoperatively when compared to 20 subjects having it preoperatively. The above mentioned subjective symptoms were proposed by the American Academy of Sleep Medicine Task Force.

Polysomnographic parameters include in this study are AHI, RDI, LAST and total snoring events. The AHI has shown an improvement of 85.9% with a preoperative average AHI of 37.8/hr and postoperative average of 5.3/hr. Objective success of this procedure based on preoperative and postoperative AHI is 100% with more than 50% improvement of AHI and postoperative AHI > 20. The preoperative average of RDI was 41.1 which reduced to 7.9 postoperatively. LSAT showed a significant improvement of 22.1% with pre and postoperative values of 71.3% and 87.1% respectively. The total snoring events drastically reduced to an average of 384.2 postoperatively when compared to the preoperative values of 3456.03.

The Epworth sleepiness scale values ranged between 8 and 19 out of 24 preoperatively with an average of 13. The postoperative values ranged between 3 and 10 out of 24 with an average of 6.5 showing an improvement of 50% on an average.

Conclusion:

The Zeta palatopharyngoplasty has been found to be effective in the management of patients with OSA.

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