Systematic Review and Meta-Analysis

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of Master Degree in **Otorhinolaryngology**

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List of Abbreviations

Abb.	Full term
AI	*Apnea Index*
AHI	*Apnea Hypopnea Index*
BAP	*Barbed Anterior Palatoplasty*
BESP	*Barbed Expansion Pharyngoplasty*
BRB	*Barbed Roman Blinds*
BRP	*Barbed Reposition Pharyngoplasty*
DSS	*Double Suspension Sutures*
EP + SS	*Expansion Pharyngoplasty with Suspension Sutures*
ESP	*Expansion Sphincter Pharyngoplasty*
FEP	*Functional Expansion Pharyngoplasty*
H-UPPP	*Han's Uvulopalatopharyngoplasty*
LP	*Lateral Pharyngoplasty*
LPMR	*Limited Palatal Muscle Resection*
MEUP	*Microdebrider Assisted Extended Uvulopalatoplasty*
MRTA	*Modified Radiofrequency Tissue Ablation*
OSAS	*Obstructive Sleep Apnea Syndrome*
PPR	*Partial Palatal Resection*
RERA	*Respiratory Effort Related Arousal*
RP	*Relocation Pharyngoplasty*
SP	*Suspension Palatoplasty*
SPFP	*Soft Palatal Webbing Flap Pharyngoplasty*
SPW	*Soft Palatal Webbing Flap*
UARS	*Upper Airway Resistance Syndrome*
UPF	*Uvulopalatal Flap*
UPPP	*Uvulopalatopharyngoplasty*
VAS	*Visual Analogue Scale*
ZP	*Z-Palatoplasty*

Abstract

Background: The first description of a patient with obstructive sleep apnea was in 'The Posthumous Papers of the Pickwick Club' published by English writer Charles Dickens in 1836[1]. The first introduction of the terms 'sleep apnea syndrome' and 'obstructive sleep apnea syndrome' was by Guilleminault et al in 1967. Subsequently, Guilleminault coined the term 'upper airway resistance syndrome' in 1993[2].

Objectives: This paper aims to examine published articles between January 2008 and January 2019 on the different palatal surgeries performed on OSA patients and the treatment outcomes, which in turn will be used to determine two things. The first being the effectiveness of various palatal surgical techniques in treating OSAS and the second (if applicable) the most effective of the palatal surgical techniques in treating OSAS.

Patients and Methods: The current review followed the guidelines of preferred reporting items for systematic reviews and meta-analysis statement 2009 (PRISMA)[5]. The detailed

steps of methods were described elsewhere as well as PRISMA checklist. The quality of relevant studies was assessed using NIH quality assessment tool for observational cohort and cross -sectional studies as well as NIH tool for quality assessment for case series studies.

Results: Meta-analyses of relevant studies showed that the surgical technique that achieved the best reduction on AHI was the lateral pharyngoplasty followed by the Anterior Palatoplasty, with a significant mean reduction of [(SMD= -0.848, 95% CI (-1.209 – -0.487), p-value<0.001) and (SMD= -0.864, 95% CI (-1.234 – -0.494), p-value<0.001), respectively]. The technique responsible for the best improvement in ESS was the Relocation Pharyngoplasty, with a significant mean reduction of [SMD= -0.998, 95% CI (-1.253 – -0.743), p-value<0.001]. Minimal O2 saturation level improved most with the Expansion Sphincter Pharyngoplasty, with a significant mean reduction of [SMD= 1.011, 95% CI (0.581 – 1.440), p-value<0.001]. The surgical procedure that result in the best post-operative VAS was Z-Palatoplasty, with a significant mean reduction of [SMD= -1. 551, 95% CI (-2.049 – -1.052), p-value<0.001]. soft palate length change with a significant mean reduction of [SMD= -2.219, 95% CI (-2.730 – -1.708), p-value<0.001]. Finally, meta-analyses of relevant studies

showed that expansion sphincter pharyngoplasty achieved the overall highest success rate [Event rate= 77%, 95% CI (65.4%–85.5%), p-value<0.001]

Conclusion: The best procedure for treating OSA varies from patient to patient and there is no universal cure-all. Careful patient selection and pre-operative evaluation are mandatory.

Keywords: Obstructive Sleep Apnea, Palatal Surgery, ESS, AHI, VAS, Oxygen Saturation, Meta-analysis, Systematic Review.

INTRODUCTION

The first description of a patient with obstructive sleep apnea was in 'The Posthumous Papers of the Pickwick Club' published by English writer Charles Dickens in 1836. The first introduction of the terms 'sleep apnea syndrome' and 'obstructive sleep apnea syndrome' was by Guilleminault et al in 1967. Subsequently, Guilleminault coined the term 'upper airway resistance syndrome' in 1993 ***(Guilleminault & Abad, 2004).***

There are three types of apneas. Central, obstructive and mixed. To put it simply:

"Central sleep apnea occurs when the CNS does not send the signal to the muscles to take a breath. Obstructive sleep apnea occurs when the brain sends the instruction to the muscles and the muscles make an effort to take a breath, but they are unsuccessful because the airway becomes obstructed and prevents an adequate flow of air. Mixed sleep apnea, occurs when there is both central sleep apnea and obstructive sleep apnea" ***(Rasmusson et al., 2012).***

"Obstructive Sleep Apnea is a common condition affecting 4% of men and 2% of women" ***(Guilleminault & Abad, 2004).*** The symptoms which patients present with are varied and include restless sleep, snoring, excessive daytime somnolence, fatigue, memory loss, decreased cognitive function, mood changes, nocturnal enuresis, nocturnal sweating and observed choking or gasping at night.

However, "The population of individuals seeking treatment for OSA is heterogeneous. At one end of the spectrum are patients with morbid obesity, carbon dioxide retention, hypertension, and right-sided heart failure with an AI of more than 100. At the other end of the spectrum are those individuals with minimal sleep-disordered breathing whose chief complaint is snoring" ***(Johnson & Braun, 2008).***

As such there is a need for a classification system for the Sleep-Related Breathing Disorders and one such example can be found in Table 1.

Table 1: Definitions of Breathing Events

Breathing Events	**Definition**
Apnea	A cessation of airflow for at least 10 seconds
Hypopnea	A reduction in airflow associated with an EEG arousal or Oxyhemoglobin desaturation
RERA (Respiratory Effort Related Arousal)	A sequence of breaths with increasing respiratory effort leading to an arousal from sleep as demonstrated by progressively decreasing esophageal pressure for at least 10 seconds preceding an arousal with resumption of normal pressures
Type of breathing event Obstructive Central Mixed	 Continued thoracoabdominal effort in the setting of partial or complete airflow cessation Lack of thoracoabdominal effort in the setting of partial or complete airflow cessation Respiratory event with both obstructive and central features. Mixed events generally begin without thoracoabdominal effort and end with several thoracoabdominal efforts
Indices of sleep disordered breathing AHI (Apnea Hypopnea Index) Apnea Index Hypopnea Index RERA Index Respiratory Disturbance Index Central Apnea Index Mixed Apnea Index	 No. of apneas and hypopneas per hour of total sleep time No. of apneas per hour of total sleep time No. of hypopneas per hour of total sleep time No. of RERAs per hour of total sleep time No. of apneas, hypopneas and RERAs per hour of total sleep time No. of central apneas per hour of total sleep time No. of mixed apneas per hour of total sleep time

Adapted from "Practice Parameters for the Indications for Polysomnography and Related Procedures: An Update for 2005" ***(Kushida et al., 2005).***

Snoring

Snoring is sound produced by the soft tissues of the pharynx and is often louder during inspiration than expiration. It does not necessarily have to be accompanied by other symptoms of sleep disordered breathing and does not need Polysomnography in order to be diagnosed. Roughly 44% of males and 28% of females snore whilst sleeping according to ***Young et al. (1993).***

UARS (Upper Airway Resistance Syndrome)

Upper Airway Resistance Syndrome is used to describe patients that do not meet the criteria for OSAS but who experience symptoms related to sleep disordered breathing. Patients with UARS suffer from what is known as RERAs (Respiratory Effort Related Arousal). A RERA is a 10 second period or more breath sequence with progressively increasing respiratory effort that ends in arousal. The pathophysiology, which will be discussed later, is not very different from that of OSAS ***(Kushida et al., 2005).***

OSAS (Obstructive Sleep Apnea Syndrome)

"OSA syndrome is defined by five or more respiratory events— apneas, hypopneas, or RERAs—in association with excessive daytime somnolence; waking with gasping, choking, or breath holding; or witnessed reports of apneas, loud snoring, or both. Each episode of apnea or hypopnea must last a

minimum of 10 seconds, is commonly accompanied by reductions in blood oxygen saturation of at least 3% to 4%, and is usually terminated by brief, unconscious arousals from sleep" ***(Wakefield et al., 2015).*** OSA can be further divided into mild, moderate and severe groups. Mild OSA: 5 – 15 events per hour, Moderate OSA: 15 – 30 events per hour, Severe OSA: > 30 events per hour.

The management of OSAS can be divided into surgical and non-surgical. Different surgeries are offered; alone or as a part of multi-tiered surgery. The UPPP technique was first introduced by ***Ikematsu*** for the treatment of snoring in ***1964*** and later popularized by Fujita and colleagues in the 1980's to treat OSA, however it had a high failure rate. Since then there have been many modifications to the original technique and the emergence of different 'flavors' of palatal surgery.