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Comparative Evaluation of Upper Airway Dimensions and Oxygen Saturation in Completely Edentulous Patients with and without Dentures

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Abstract

Background: Majority of the elderly people complain of difficulty in sleeping. Although the causes for the sleep disturbances may be multifactorial in nature, the sleep disordered breathing (SDB) is one of the primary disorder. The study was undertaken to study the effect of Complete Denture rehabilitation which could have profound impact on rehabilitation protocol on complete edentulous patients. Aim: The aim of this study is to Cephalometrically evaluate the effect of complete denture rehabilitation on upper airway dimensions and position of hyoid bone and also to examine if complete denture rehabilitation influences oxygen saturation and degree of sleepiness by overcoming upper airway collapsibility. Material and Method: 30 edentulous patients who complained of snoring during sleep were selected for the study. The baseline lateral cephalogram of all the patients were taken by asking the patient to attain the natural head position.MAS (Minimal Airway Space), PAS (Posterior Airway Space), SAS (Superior Airway Space), MP-H (Perpendicular distance from hyoid bone to mandibular plane) were also recorded. The patients were also subjected to pulse oximetry test to assess the oxygen saturation and ESS (Epworth Sleepiness Scale) to assess the day time sleepiness. All these subjects were rehabilitated using conventional complete denture fabricated using standard prosthodontic protocol and after 6-8 weeks they were subjected to same tests again with dentures in situ. Results: The results of this study showed no statistically significant difference on MAS (Minimal Airway Space), PAS (Posterior Airway Space), SAS (Superior Airway Space), MP-H (Perpendicular distance from hyoid bone to mandibular plane), ESS (Epworth Sleepiness Scale) and Oxygen saturation. Conclusion: Wearing the Complete Denture during night does not improve the airway space, oxygen saturation and day time sleepiness significantly when compared with edentulous patients. Aim:The aim of this study is to Cephalometrically evaluate the effect of complete denture rehabilitation on upper airway dimensions and position of hyoid bone and also to examine if complete denture rehabilitation influences oxygen saturation and degree of sleepiness by overcoming upper airway collapsibility.

Index terms— sleep disordered breathing, obstructive sleep apnea, epworth sleepiness scale.

1 I. Introduction

isturbed sleep is a common source of disgruntlement among elderly people. It is estimated that up to 50% of elderly adults complain of difficulty in sleeping, further aggravating the risks of morbidity in the ageing

population [1]. It has been described that 43% of those over the age of 65 have difficulty in the onset and maintenance of sleep, while 25% report daily drowsiness [2]. Many authors in 1970 delineated the causes of upper airway sleep disorders and in 1980 they described the oral appliances as pivotal treatment modality. Drowsiness and symptoms of sleep disturbance have been associated with declining cognitive capacity, depression, falls and mortalities. Sleep disturbances are multifactorial in nature and could be impacted by alterations of the circadian rhythm, neuropsychological impairment, use of medications and some medical conditions. In most of the cases disturbed sleep is constantly associated with sleep-disordered breathing (SDB) which can range from the cessation of respiration lasting for at least 10 seconds (apneas) and or partial or reduced respiration (hypopne as) during sleep [3].

One of the exacerbating factors that were recommended to allay SDB is edentulism. Complete tooth loss sequels in anatomical changes that may sway upper airway dimensions and pass out by influencing the postural rest position of the mandible, muscle tone and tongue posture during sleep. A decrease in retropharyngeal space and or the hypotonicity of the pharyngeal musculaturein edentulous people have been recommended to increase the collapsibility of airways **??**4]. Using supine lateral cephalometric studies in complete denture wearers, Bucca et al, substantiated decreased in retropharyngeal space and anteroposterior oropharyngeal distance in the absence of dentures. They found that there may be perpetuation of OSA (Obstructive Sleep Apnea) and lower arterial hemoglobin oxygen saturation in patients following the removal of dentures. Thus, they collectively assign edentulism as a reason for exacerbation of OSA **??**5] There are very few studies to analyze the role of complete denture rehabilitation on the upper air way dimension and its influence on oxygen saturation to analyze and assess whether edentulism favors the occurrence or alleviating of OSA which would have intense effect on rehabilitation protocol in complete edentulous patients with SDB.

2 II. Materials and Method

The samples were taken from the completely edentulous patients visiting our institution seeking complete dentures. All patients were informed of the modalities and purpose of the study before obtaining consent to participate. The inclusion criteria for the study were first time complete edentulous patients with wellformed residual ridges in class I relation, presence of snoring or known case of obstructive sleep apnea, age group of between 50-70 years, clinically stable with no systemic involvement especially respiratory disease and infections. The exclusion criteria included any metabolic or craniofacial syndrome, BMI>3, nasal obstruction, pharyngeal tumours, history of tongue, palate or upper airway surgery, skeletal class III relationship, grossly resorbed residual alveolar ridges and musculo skeletal disorders.

All complete dentures were made and assessed by the same clinician at all stages and were fabricated by the same technician in accordance with the standard prosthodontic treatment and laboratory protocol.

The sample consisted of 30 edentulous patients who complained of snoring. Out of which 14 were males and 16 were females with mean age of 63.15 Yrs. Baseline lateral cephalograms were recorded at the end expiration, palate not involved in deglutition and jaws in physiologic rest position by asking the patients to attain natural head position (NHP) Fig **??** and Fig 2 **??** To attain NHP, patients were made to stand without head fixation in cephalost at, after moving head forward and backward 3 times, swallowing and lips at rest. Exposure time and other parameters were kept constant and radiographs were made with a film object distance of 180 cm and film to median plane distance of 10 cm which was constant for both pre and post cephalometric radiographs.

All the patients were also subjected to overnight pulse oximetry test to assess oxygen saturation and ESS (Epworth Sleepiness Scale) to assess day time sleepiness Fig **??** and Fig 4.

All the 30 study subjects were rehabilitated with conventional polymethyl methacrylate complete dentures (CD) using standard prosthodontic fabrication protocols. After 6-8 weeks, following the use of CD and having observed the compliance of use, they were subjected to lateral cephalograms with CD in situ as per standardised protocol followed during pre-treatment cephalometry using the same cephalometric machine. All the rehabilitated study subjects were also subjected to overnight pulse oximetry with wearing CD to assess oxygen saturation and ESS scores were evaluated. The data recordings of sleep duration lasting for more than 4 hrs were considered as acceptable for the purpose of our study.

Based on the outer border of the radiograph, vertical and horizontal lines were traced perpendicular to each other. These two lines acted as references to calculate the angles between the head and neck on the cephalograms and the measurements for Posterior Airway Space (PAS), Minimal Airway Space (MAS), Superior Airway Space (SAS) and Perpendicular distance from hyoid bone to mandibular plane (M-PH).

(Fig 5 and Table 1)

3 III. Results

The mean SAS without dentures was 8.96mm (±1.84) and with denture wear was 8.90 mm(±1.79) with difference in mean of 0.06 (±0.52). The comparison of means was done using paired T test, wherein P value was of 0.48 indicating no statistically significant difference in SAS, between with and without denture wearers (Table 2). The mean MAS without dentures was 7.00 mm (±1.59) and with denture wear was 7.30 mm (±1.46) with difference in mean of 0.30 (±0.53). The P value was of 0.005 indicates statistically significant difference in MAS, between with and without denture wearers (Table 3).The mean PAS without dentures was 11.76 mm (±1.83) and with

denture wear was 11.93 mm (±2.08) with difference in mean of 0.16 (± 0.53). The P value of 0.096 indicates no statistically significant difference in PAS, between with and without denture wearers (Table 4).The mean H-distance without denture was 11.73 mm (± 1.7) and with denture wear was 11.7 mm (±2.08) with difference in mean was 0.03(± 0.85). The P value of 0.83 indicates no statistically significant difference in H-Distance to the mandibular plane, between with and without denture wearers (Table 5).The ESS score without denture was 8.83 (± 1.64) and with denture wear was8.83(± 1.81) with difference in mean of 0.00 (± 0.74). The P value of 1.00 indicating no statistically significant difference in ESS between with and without denture wearers (Table 6).The Oxygen saturation percentage score without dentures was 93.30 (±1.74) and with denture wear was 93.20 (±1.58) with difference in mean of 0.10 (± 0.88). The P value of 0.54 indicates no statistically significant difference in Oxygen Saturation percentage between with and without denture wearers (Table 7).

4 IV. Discussion

From a methodical viewpoint, sleep is defined on the basis of both the behavior of the person while asleep and related physiological changes that occur to Increased pharyngeal collapsibility is a frequent cause of obstructive sleep apnea (OSA) [5] which results from the combination of anatomical abnormalities of the upper airway with changes in neural activation mechanisms. Innumerable structural changes in facial morphology have been associated with OSA pathogenesis like retrognathic mandibles, posteriorly placed pharyngeal walls, large tongues and soft palate. Missing teeth produces prominent anatomical changes that may influence upper airway size and function, such as decreased vertical dimension of occlusion, reduction of the lower third facial height and mandible rotation correlating its role in the pathogenisis of OSA **??**7].

Bucca et al **??**5][8] confirmed that removal of dentures significantly decreases the retropharyngeal space and sleeping without dentures is associated with significant decrease in Apnea -Hypopnea Index (AHI) and decrease in mean arterial hemoglobin saturation. The authors stressed the fact of wearing complete dentures during night will negate the effects of OSA. Their results were in contrast to our study results, wherein there was no significant difference in cephalometric findings in Superior Airway Space (SAS) (Table 2) and Posterior Airway Space (PAS) (Table 4) whereas there was a significant difference in Minimal Airway Space (MAS) (Table 3) between patients with and without complete dentures. This could be because our study sample was of non-confirmed cases of OSA with only snoring as an inclusion criteria.

Ergovini et al [9] described the effect of removal of dentures and modifications of prosthesis on pharyngeal collapse and showed statistically significant reduction in PAS. They concluded that wearing denture induces modifications in the position of tongue, the jaw and the pharyngeal air way space which was not in accordance with our study. This may be because of the selection of sample size of 27 subjects with reduced vertical dimension compared to our study sample of ideal jaw relations.

Gupta et al [4] evaluated completely edentulous patients cephalometrically with increasing vertical jaw relation using an acrylic jig of 2 -3 mm and revealed that there was a statistically significant correlation between PAS and retropharyngeal space between edentulous and patients with complete dentures and they concluded that increasing vertical dimension of occlusion within acceptable limits is beneficial to patients with OSA.

Navone PS [10] and Ariska et al **??**11] had evaluated the risk for OSA in completely edentulous patients with and without complete dentures respectively and concluded that the episode of AHI increases along with reduction in oxygen saturation and retropharyngeal space without dentures indicating worsening of the OSA among subjects. But although there was a definite improvement of AHI among all denture wearers, the oxygen saturation level was recorded at 95.4 ± 2.4 without dentures and 95.6 ± 1.6 with dentures indicating no statistically significant difference. This result is in concurrence to our study wherein the oxygen saturation level was recorded at 93.30 ± 1.74 without dentures and 93.20 ± 1.58 reveling no statistically significant difference.

In a study by Tsuda et al **??**12], they demonstrated that edentulism favors upper airway obstruction during sleep. In fact, both AHI and mean SaO2 were significantly worse in the patients who slept without dentures than in the patients slept with dentures. Almeida analysed completely edentulous patients with OSA and contrary to other study findings concluded that dentures substantially increases AHI especially in supine position. They had the mean oxygen saturation percentage value of 94.2 ± 1.57, almost similar to our study findings 93.25 ± 1.31(Table 7), which is almost nearer to the proved normal basal oxygen saturation of 95.5 %. The findings may be attributed due to the recordings taken only during sleep and supine position and not compared with patients when awake. This can be attributed due to interruption of elevator muscles due to the denture wear during sleep leading to the more collapsibility of the airway thus leading to reduced oxygen saturation. The day time sleepiness measured using Epworth Sleepiness Scale score was 10.2 ± 4.4 compared to our results of 8.83 ± 1.72,(Table 6), indicating there was no EDS compared between patients with or without complete dentures. The variation between the results may be attributed to the selection of subjects with Non confirmed OSA subjects selected by us.

Our study results showed no correlation between oxygen saturation and hyoid bone distance to mandibular plane. The antero posterior measurement of retro pharyngeal space on cephalograms at three areas of SAS, PAS and MAS, revealed only MAS significant when compared between completely edentulous patients wearing with and without complete denture.

5 V. Conclusion

Within the limitation of the study it is concluded that: Denture wearing at night in healthy completely edentulous patients will not significantly improve quality and quantity of sleep as determined by oxygen saturation levels and ESS scoring. There is no significant increase in airway space and oxygen saturation levels are not affected with the use of complete dentures during sleep.It is recommended that further studies involving large sample size with OSAS may be required to be studied to conclusively prove the hypothesis of wearing denture at night improves the air way space and reduces the symptoms of OSAS.Further studies with confirmed OSA patients and varying the prosthesis vertical dimension of occlusion and MRI study with 3-D measurements may give definite insight on understanding their effect on sleep parameters and on airway changes. [1]

Figure 1:

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Figure 2: Figures

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Figure 3: Figure 1 : 2 :

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Figure 4: Figure 3 :Figure 4 :Figure 5 :

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4. Gupta P, Thombare R, Pakhan AJ, Singhal S. Cephalometric evaluation of the effect of complete dentures on retropharyngeal space and its effect on spirometric values in altered vertical dimension. ISRN Dent 2011; 51: 69.
5. Bucca C, Carossa S, Pivetti S, Gai V, Rolla G, Preti G. Edentulism and worsening of obstructive sleep apnea. Lancet 1999 Jan; 353(9143): 121-2.
6. Chokroverty S. An overview of normal sleep. Sleep disorders medicine: Basic science, technical-considerations and clinical aspects, 3rd ed. Philadelphia: Elsevier/Butterworth; 2009.
7. Morelli DL, Jackson N, Gislason T, Arnardottir ES et al. The Effect Of Edentulism On Ahi, Odi, And Tongue Morphology In Iceland Sleep Apnea Cohort (ISAC). Am J RespirCrit Care Med 183; 2011: 3676.
8. Arisaka H, Sakuraba S, Tamaki K, Watanabe T, Takeda J, Yoshida K. Effect of wearing complete dentures during sleep on the apnea-hypopnea index. Int J Prosthodont2009 Mar -Apr; 22(2):173-7.
9. Bucca C, Cicolin A, Brussino L et al. Tooth loss and obstructive sleep apnea. Respir Res. 2006 Jan 17; 7:8.
10. Carossa S, Bucca C, De Lillo A, Corsalini M, Rizzatti A, Lombardo S, Pera P. Correlation between edentulism, sleep disorders and a hypertension. Preliminary research. M Stomatol. 2000 Sep; 49(9): 399-404.
11. Gupta P, Thombare R, Singhal S, Pakhan AJ. Obstructive sleep apnea and edentulism-role of complete dentures/oral appliance fr prosthodontic respective: a review. Indian J Sleep Med 2010; 5: 116-119.
12. Tsuda H, Almeida FR, Walton JN, Lowe AA. Questionnaire-based study on sleep-disordered breathing among edentulous subjects in a university oral health center. Int J Prosthodont. 2010 Nov-Dec; 23(6): 503-6.

[Note: Tables]

Figure 5: Table 1 :

2

Variable	Pre treatment		Post treatment		Mean of Diff	P value
	Mean	SD	Mean	SD		
SAS	8.96	1.84	8.90	1.79	0.066	0.489

Figure 6: Table 2 :

3

Variable	Pre treatment		Post treatment		Mean of Diff	P value
	Mean	SD	Mean	SD		
MAS	7.00	1.59	7.30	1.46	0.30	0.005

Figure 7: Table 3 :

4

Variable	Pre treatment		Post treatment		Mean of Diff	P value
	Mean	SD	Mean	SD		
PAS	11.76	1.83	11.93	2.08	0.16	0.096

Figure 8: Table 4 :

5

Variable	Pre treatment		Post treatment		Mean of Diff	P value
	Mean	SD	Mean	SD		
H -Distance	11.73	1.70	11.70	2.08	0.03	0.831

Figure 9: Table 5 :

6

Variable	Pre treatment		Post treatment		Mean of Diff	P value
	Mean	SD	Mean	SD		
ESS	8.83	1.64	8.83	1.81	0.00	1.000

Figure 10: Table 6 :

7

Variable	Pre treatment		Post treatment		Mean of Diff	P value
	Mean	SD	Mean	SD		
Oxy Sat	93.30	1.74	93.20	1.58	0.10	0.541

Figure 11: Table 7 :

[Ivanhoe et al. (1999)] 'Dental considerations in upper airway sleep disorders: a review of the literature'. J R Ivanhoe , R M Cibirka , C A Lefebvre , G R Parr . *J Prosthet Dent* 1999 Dec. 82 (6) p. .

[Foley et al. ()] 'Incidence and remission of insomnia among elderly adults: an epidemiologic study of 6,800 persons over three years'. D J Foley , A Monjan , E M Simonsick , R B Wallace , D G Blazer . *Sleep* 1999. 22 p. .

[Vazfragoso and Gill (2007)] 'Sleep complaints in community-living older persons: a multifactorial geriatric syndrome'. C A Vazfragoso , T M Gill . *Journal of the American Geriatrics Society* 2007 Nov. 5 (11) p. .