

# Impact of Dentures Wearing on Retropharyngeal Space in Edentulous Patients; Data From Rural Tertiary Hospital

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## ABSTRACT

**Introduction:** Few studies have been performed in past to analyse the role of complete denture in reducing apnea-hypopnea index in edentulous obstructive sleep apneic patients. Not many studies were attempted to evaluate the effect of wearing complete dentures in edentulous patients on retropharyngeal space. The study was done to see the role of dentures on modifications in the position of the jaw, tongue, soft tissues and retropharyngeal space, thus preventing obstructive sleep apnea by restoring the lost vertical dimension.

**Material and Methods:** The 20 edentulous patients visiting the Department of Prosthodontics for complete denture prosthesis were selected as subjects for this study. The same subjects were subjected to cephalometry after providing dentures with acceptable vertical dimension of occlusion and the effect of this on retropharyngeal space, posterior airway space, pharyngeal depth and readings were compared with those in edentulous group.

**Results:** Significant changes were observed with increase in retropharyngeal space, posterior airway space, pharyngeal depth at level of second cervical vertebrae as compared to edentulous patients whereas no significant variations were found in pharyngeal depth at level of fourth cervical vertebra.

**Conclusion:** This study paves the way for doing further research for the consideration of using complete dentures to reduce the plight of an edentulous obstructive sleep apnea patient.

**Keywords:** Retropharyngeal Space, Denture, Edentulous, Vertical Dimension

## INTRODUCTION

There is decrease in size and tone of pharyngeal musculature in edentulous patients and predisposes to obstructive sleep apnea.<sup>1,2,3</sup> Literature review reveals that in a patient with obstructive sleep apnea, extraction of all teeth manifested worsening of the cardio-respiratory symptoms associated with almost doubling of the number of episodes of apnea/hypopnea per hour.<sup>3</sup> Obstructive sleep apnea syndrome (OSAS) is a disorder characterised by repeated obstruction of the upper airway, with consequent episodes of apnea and hypopnea during sleep, snoring, and day time sleepiness.<sup>4,5</sup> Increased pharyngeal collapsibility is reported to be a common cause of obstructive sleep apnea. It may be functional in nature viz. muscular hypotonicity or anatomic in character due to conditions like macroglossia, retrognathia, micrognathia and soft tissue hyperplasia leading to reduction in size of the lumen of the airway.

There is reduced face height and rotation of mandible in edentulous patients and increases the risk of obstructive

sleep apnea. Obstructive sleep apnea is a common disorder, especially in elderly people older than 50 years of age. 61% of elderly people are prone to develop obstructive sleep apnea.<sup>6</sup> Applying prosthodontics appliances viz. Mandibular repositioning devices and Tongue repositioning devices may comply with the need as a treatment modality for these patients who present surgical risks or have had unsuccessful response to surgical procedures.<sup>4</sup> Above study was done to judge the role of complete dentures on modifications in the position of the jaw, tongue, soft tissues and retropharyngeal space, thus precluding obstructive sleep apnea by restoring the lost vertical dimension.

## MATERIAL AND METHODS

20 edentulous patients between age 40-70 years were chosen with no respiratory problem and having average/well formed alveolar ridge. They were explained about the study and written consent was taken before enrollment. Approval of institutional ethical committee was taken and study was performed as mentioned below-

### Fabricating complete denture for selected subjects:

Routine procedure of impression making, recording jaw relation, selection and arrangement of teeth was followed. After approval of try-in of waxed denture, they were processed following conventional method, using standard material for all subjects. Complete dentures so fabricated were provided proper vertical dimension of occlusion.

### Taking lateral cephalographs:

Lateral cephalographs were obtained in a standardized manner. Natural head posture (mirror technique) at end expiration was maintained, without swallowing and teeth were maintained in centric occlusion. Centre X ray beam was directed perpendicular to the right external auditory meatus. Proper precautions were taken while obtaining the cephalographs to avoid radiation hazards.

### Two lateral cephalographs for the same subject were

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**shooted:**

1. Lateral Cephalograph of edentulous subjects (Fig.1)
2. Lateral Cephalograph (Fig.2) of same edentulous subject wearing complete denture with acceptable vertical dimension of occlusion

These cephalographs were then developed using standard technique.

**Tracing of Lateral Cephalograph**

Chealometric tracing was done on acetate tracing paper using standard orthodontic practice with a sharp HB pencil.

**Following Cephalometric Reference Points were identified:**

- Lp- point on anterior wall of oropharynx
- Mp- point on posterior wall of oropharynx
- cv2ia- the most anteroinferior point on the corpus of the second cervical vertebrae
- cv4ia- the most anteroinferior point on the corpus of the fourth cervical vertebrae
- ppw2- the posterior pharyngeal wall along the line intersecting Cv2ia and hy
- ppw4- the posterior pharyngeal wall along the line intersecting Cv4ia and hy
- hy- the most superior and anterior point on the body hyoid bone
- apw2- the anterior pharyngeal wall along the line intersecting cv2ia and hy
- apw4- the anterior pharyngeal wall along the line intersecting cv4ia and hy
- tb- the intersection point of a line from point B through go and the base of the tongue
- Point B- (supramentale)- the point at the deepest midline concavity on the mandibular symphysis between infradentale and pogonion
- go- gonion-the constructed point of intersection of the ramus plane and the mandibular plane
- Po-porion-the superior point of the external auditory

meatus.

- Or-orbitale-the lowest point in the inferior margin of the orbit.
- ppwb- the intersection point of a line from B through go and the base of the posterior pharyngeal wall
- Mp-Lp(Retropharyngeal space [RPS])- the smallest distance between the anterior (Lp) and posterior wall of oropharynx.
- apw2-ppw2- pharyngeal depth at level of second cervical.
- apw4-ppw4- pharyngeal depth at level of fourth cervical vertebrae.
- PAS (posterior airway space)- linear distance between a point on the base of tongue (tb) and another point on the posterior pharyngeal wall (ppwb), both determined by an extension of line from point B through go.

Tracings were done for all subjects for both the groups of lateral cephalographs (Fig 1 and 2) Readings were obtained using digital caliper.

**STATISTICAL ANALYSIS**

Statistical analysis was done by applying ANOVA (analysis of variance), Dunnett 'D' test and paired 't' test in control group and interventional group using SPSS software and 'p' value was obtained. 'p' value less than 0.05 was considered as significant.

**RESULTS**

Tracings of lateral cephalographs were carefully evaluated for all subjects and values recorded (Table 1) were compared with control group (edentulous subjects) to know the change in dimensions of retropharyngeal space when complete dentures with acceptable vertical dimensions were used by the same patients.

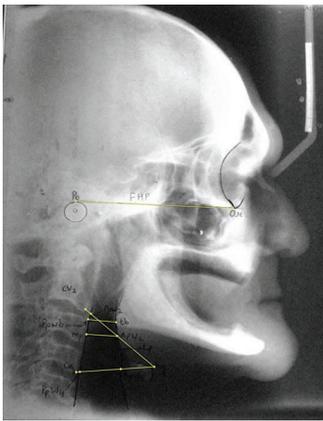
Applying One-way ANOVA, Dunnett 'D' test and paired 't' test, significant variations were found in retropharyngeal space, posterior airway space, pharyngeal depth at level of

		Range (Min. - Max. value)	Mean value	Percentage increase in comparison to control group
Retropharyngeal space (Mp-Lp) in mm	Edentulous subjects (control group)	6.59-20.18	11.97	0%
	Denture group	9.64-22.32	14.14	18.12%
Posterior airway space in mm	Edentulous subjects (control group)	6.08-23.07	12.63	0%
	Denture group	7.98-24.96	14.50	14.80%
apw2-ppw2 in mm	Edentulous subjects (control group)	8.98-22.15	13.55	0%
	Denture group	9.92-24.39	15.75	16.23%
apw4-ppw4 in mm	Edentulous subjects (control group)	10.56-26.44	18.74	0%
	Denture group	12.56-27.07	20.33	8.48%

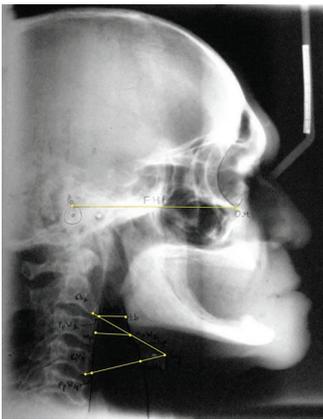
**Table-1:** Recorded Lateral Cephalograph and effect of dentures on retropharyngeal spaces

	One-way ANOVA (p value)	Dunnett 'D' test p value between control group and denture group	paired 't' test (p value)
Retropharyngeal space	0.000 *S	0.007 S	0.004 S
Posterior airway space	0.000 S	0.042 S	0.015 S
apw2-ppw2	0.000 S	0.016 S	0.002 S
apw4-ppw4	0.001 S	0.103 NS	0.099 NS

**Table-2:** Statistical Analysis of Cephalograph and effect of dentures on retropharyngeal spaces



**Figure-1:** Lateral cephalograph of the edentulous subject



**Figure-2:** Lateral cephalograph of the same subject with acceptable VDO

second cervical vertebrae between control and denture group (Table 2).

## DISCUSSION

It is well evident that edentulous patients have high incidence of obstructive sleep apnea in comparison to general population.<sup>9</sup> There are changes in upper airway size and function, reduction in lower face height and mandible rotation.<sup>10</sup> Rehabilitation of edentulous patient with complete dentures is an integral part of prosthodontic treatment modality. A denture not only provides esthetics and improves the phonetics but also restores the desired function of mastication and also provides adequate support to oro-facial structures by restoring altered vertical dimension of face and also improve the conditions like OSA/hypoapnoea.

Few studies have been done in past to investigate the role of complete denture in reducing apnea-hypoapnea index in edentulous obstructive sleep apneic patients.<sup>1,2,3,11</sup>

These studies reported in literature have demonstrated that wearing complete dentures causes increase in the retropharyngeal space in supine position in edentulous patient with obstructive sleep apnea thereby reducing the severity of apnea-hypoapnea events. The present study was done to evaluate changes in retropharyngeal space in edentulous patients after wearing complete dentures.

Normal edentulous patients were selected as subjects and

complete denture were given using standard conventional method. both male and female patients were taken as subjects.

Significant changes were observed in present study with mean increase of 2.16 mm of retropharyngeal space in comparison to edentulous subjects with  $p$  value  $< 0.05$ . In one of the study<sup>1</sup> done in past on 6 edentulous patients it was observed that retropharyngeal space was reduced from 15mm to 6mm, leading to increased apnea hypopnea events. Later on same results were obtained in another study<sup>3</sup> in which the authors hypothesized that edentulism might act in creating the apnoea condition by modifying anatomy and thereby affecting the functions of the pharyngeal airway and of tongue and may be by favouring inflammatory edema.

They concluded that risks of removing denture in edentulous patients should be weighed against risk of upper airway collapse. they also observed mean increase of 1.88 mm in posterior airway space and increase of 2.20 mm in pharyngeal depth in comparison to edentulous patients with  $p$  value  $< 0.05$ .

Posterior airway space is unusually small in obstructive sleep apnea patients.<sup>12</sup>

Meyer and Knudson in 1990 try to give a solution for the same by making a prosthesis which causes vertical and protrusive jaw position with significant increase in posterior airway space in edentulous patients.<sup>13</sup> Robertson CJ in 1998 observed in a study that increasing vertical dimension of prosthesis in edentulous obstructive sleep apnea patients prevents dislodgment of the same during night.<sup>14</sup> Thus are in agreement with the findings of this study.

In the latest study done in Japan, authors found that wearing complete dentures during sleep improves the apnea-hypoapnea index in most of the patients. They further stated that this effect was due to reduction in partial pharyngeal obstruction when patient wore complete dentures during sleep.<sup>11</sup>

Some authors advocate using mandibular advancing devices with or without tongue retaining devices for increasing posterior airway spaces.<sup>15,16,17,18</sup> A mandibular advancement splint was used for edentulous obstructive sleep apnea patient using clinical procedures that were similar to those for fabricating a conventional complete denture without increasing the vertical dimension of occlusion.<sup>16</sup> A new functional appliance with combine characteristics of mandibular advancement splint and tongue retaining device with a custom made tongue tip housing without increasing vertical dimension of occlusion, was fabricated for an edentulous obstructive sleep apnea patient popularly named as Mandibular and Tongue Repositioner (MTR).<sup>18</sup>

An oral appliance fabricated like a denture with artificial teeth that not only reduced the severity of obstructive events but also provided an esthetic look to the patient with moderate obstructive sleep apnoea.<sup>17</sup> In another case report documented in year 2007<sup>19</sup>, an implant retained mandibular repositioning appliance in the mandible was provided as a viable treatment modality in edentulous obstructive sleep apnea patients.

The advantage of using dentures in edentulous patient during sleep resulted in reducing apnea-hypopnea events in edentulous obstructive sleep apnea patient. This occurred due to the fact that wearing dentures induces modifications in the position of the jaw, tongue, soft tissue, and pharyngeal airway space<sup>20</sup> that may contribute to the reduction of apnea events. Moreover, since wearing complete dentures might not change the horizontal mandibular position as oral appliance do, it might help to restore the vertical mandibular position. Thus, the denture itself can act as an oral appliance and provides esthetic look to the patient. The result of this study is in confirmation of the above findings. The disadvantages of wearing dentures during sleep are due to the fact that they are associated with chronic inflammatory changes,<sup>21</sup> leading to irritation and alveolar bone resorption in the denture-supporting area.

## CONCLUSION

In edentulous subjects, the retropharyngeal space (RPS) and posterior airway space (PAS) were observed to be reduced due to anatomical changes causing decrease in vertical dimension resulting into collapse of oro-facial structures and increased after wearing complete dentures due to restoration of vertical dimension of occlusion. These significant differences are important from the point of view of edentulous patients having obstructive sleep apnea in which there are unusually small retropharyngeal and posterior airway spaces. By providing complete dentures fabricated with acceptable vertical dimension of occlusion can minimize the pharyngeal collapsibility, thereby reducing apnea-hypopnea events.

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