

Original Research

Assessment of the effect of Complete Dentures on Respiratory performance

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ABSTRACT:

Background: To assess the effects of complete dentures on respiratory performance. **Materials & Methods:** A total of 20 participants were included in the study. All the necessary spirometry examinations were conducted. The measurements taken during the spirometric assessment included Forced Vital Capacity (FVC), Peak Expiratory Flow (PEF), Forced Expiratory Volume in 1 second (FEV1), and FEF₂₅₋₇₅. **Results:** The spirometric measurements for FVC, PEF, FEV1, and FEF₂₅₋₇₅ were taken under different conditions. During Stage 1, where no dentures were worn, the recorded values were 3.10, 5.80, 2.48, and 2.75, respectively. **Conclusion:** There was a significant decrease in the value of spirometric variables in the presence of dentures.

Keywords: spirometry, Complete dentures, forced vital capacity.

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INTRODUCTION

Associations between oral health and various respiratory diseases have been recognised for some time.¹ Strong evidence and biological plausibility exists for an association with nosocomial hospital-acquired pneumonia.² A recent systematic review concluded that pathogenic bacterial species identified in the mouth are associated with a higher incidence of aspiration pneumonia in older people in residential care.³ Poor oral health has also been implicated in chronic obstructive pulmonary disease (COPD).^{2,4} COPD is characterised by persistent reduction and accelerated rate of decline in forced expiratory volume (FEV1). The disease is associated with an enhanced chronic airway inflammatory response to noxious particles or gases.⁵ It has a worldwide prevalence of ~10% in adults >40 years of age and is now the third most common cause of global mortality such that in 2015 COPD was responsible for 3.2 million deaths worldwide, an increase of 12% compared with 1990.⁶

Among the vital functions, respiration can be claimed to be one of the most important. It can be considered

to be an exchange of air or gases between a living being and the outside atmosphere in order to fulfill the metabolic requirements of the body. In the course of this respiring process, the oral tissues and the prosthetic dentures are basically the first structures that come in contact with the air moving up the airways.^{7,8} Spirometry requires recording the volume of air inhaled and exhaled, plotted against time, during a series of ventilatory maneuvers. The resulting curves permit the determination as to whether the subject has a normal ventilatory reserve or an abnormal pattern characteristic of obstructive, restrictive, or mixed ventilatory abnormalities. None of these patterns is specific, although most diseases cause a predictable type of ventilatory defect. Spirometry alone cannot establish a diagnosis of a specific disease, but it is sufficiently reproducible to be useful in following the course of many different diseases. In addition, the results of spirometry make it possible to estimate the degree of exercise limitation due to a ventilatory defect (e.g., maximal voluntary ventilation [MVV] can be predicted from the forced expiratory volume in 1 second [FEV1]) and to

identify the type of patient likely to develop ventilatory failure after pneumonectomy.^{9,10} Hence, this study was done to evaluate the effects of complete dentures on respiratory performance.

MATERIALS & METHODS

A total of 20 participants were included in the study. The individuals had been using dentures for approximately 5 years. All the necessary spirometry examinations were conducted. The measurements taken during the spirometric assessment included Forced Vital Capacity (FVC), Peak Expiratory Flow (PEF), Forced Expiratory Volume in 1 second (FEV1), and FEF₂₅₋₇₅. A diagnostic spirometer was utilized for executing the spirometry tests. The testing procedure encompassed the following stages:

1. Testing conducted without wearing dentures.
2. Testing performed while wearing both upper and lower dentures.
3. Testing carried out while wearing only the upper denture.
4. Testing executed while wearing only the lower dentures.

The collected data were subjected to analysis using SPSS software.

RESULTS

A total of 20 participants were enlisted, with an average patient age of 64.4 years. The spirometric measurements for FVC, PEF, FEV1, and FEF₂₅₋₇₅ were taken under different conditions. During Stage 1, where no dentures were worn, the recorded values were 3.10, 5.80, 2.48, and 2.75, respectively. In Stage 2, when both maxillary and mandibular dentures were worn, the respective values were 3.01, 5.65, 2.36, and 2.70. For Stage 3, with only the maxillary denture in place, the values came out to be 2.87, 5.52, 2.38, and 2.68. Finally, during Stage 4, when only the mandibular denture was worn, the corresponding values were 2.93, 5.48, 2.33, and 2.59.

Table: spirometry values

Spirometric values	Mean values
Stage 1	
FVC	3.10
PEF	5.80
FEV1	2.48
FEF ₂₅₋₇₅	2.75
Stage 2	
FVC	3.01
PEF	5.65
FEV1	2.36
FEF ₂₅₋₇₅	2.70
Stage 3	
FVC	2.87
PEF	5.52
FEV1	2.38
FEF ₂₅₋₇₅	2.68
Stage 4	

FVC	2.93
PEF	5.48
FEV1	2.33
FEF ₂₅₋₇₅	2.59

FVC: Forced vital capacity, PEF: Peak expiratory flow, FEV1: Forced expiratory volume in 1 s, FEF₂₅₋₇₅: Forced expiratory flow 25%-75%

DISCUSSION

The main finding of the population-based nested case-control study was that denture wearing, in men who retained some of their natural teeth, was associated with reduced lung function (as measured by FEV1) and increased airflow limitation (as measured by a reduction in FEV1/FVC ratio and application of the GOLD criteria). This relationship remained significant after adjustment for various known confounders. Further, the level of moderate to severe airflow limitation in edentulous men, who wore complete dentures, was even higher than partially dentate denture wearers. To the best of our knowledge this is the first report of a link between denture wearing and reduced lung function in a population-based study. Airflow limitation, which characterises chronic obstructive airway disease, is a major public health burden.¹¹ Hence, this study was done to evaluate the effects of complete dentures on respiratory performance.

In the present study, a total of 20 participants were enlisted, with an average patient age of 64.4 years. The spirometric measurements for FVC, PEF, FEV1, and FEF₂₅₋₇₅ were taken under different conditions. During Stage 1, where no dentures were worn, the recorded values were 3.10, 5.80, 2.48, and 2.75, respectively. A study by Kelly N et al, 353 cases who were partially dentate and were confirmed denture wearers. They were matched for age and smoking habit to never denture wearer controls. The cases had an FEV1 that was on average 140 ml lower than the controls, $p = 0.0013$ and a 4% reduction in percent predicted FEV1, $p = 0.0022$. Application of the GOLD criteria indicated that 61 (17.3%) of the cases had moderate to severe airflow limitation compared with 33 (9.3%) of controls, $p = 0.0051$. Fully adjusted multivariable analysis showed that partially dentate men who were denture wearers were significantly more likely ($p = 0.01$) to have moderate to severe airflow reduction with an adjusted odds ratio (OR) of 2.37 (95% confidence intervals 1.23–4.55). In the 153 edentulous men studied moderate to severe airflow limitation was recorded in 44 (28.4%), which was significantly higher than in the partially dentate denture wearers ($p = 0.017$), and the men who had never worn a denture ($p < 0.0001$). Denture wearing was associated with an increased risk of moderate to severe airflow limitation in the cohort of middle-aged Western European men studied.¹²

In the present study, Stage 2, when both maxillary and mandibular dentures were worn, the respective values were 3.01, 5.65, 2.36, and 2.70. For Stage 3, with only

the maxillary denture in place, the values came out to be 2.87, 5.52, 2.38, and 2.68. Finally, during Stage 4, when only the mandibular denture was worn, the corresponding values were 2.93, 5.48, 2.33, and 2.59. Another study by Shah Bukhari JA et al, was conducted for assessing the effect of complete dentures on respiratory performance. Fifty patients with the presence of complete edentulous arch and who had a history of complete denture usage for at least 5 years were enrolled. Forced vital capacity (FVC) value, peak expiratory flow (PEF) value, forced expiratory volume in 1 s (FEV1) value, and forced expiratory flow 25%–75% (FEF25–75) value were recorded with the spirometric test. The spirometric value of FVC, PEF, FEV1, and FEF25–75 in the absence of both maxillary and mandibular dentures (Stage 1) was found to be 3.18, 5.83, 2.44, and 2.80, respectively. The spirometric value of FVC, PEF, FEV1, and FEF25–75 in the presence of both maxillary and mandibular dentures (Stage 2) was found to be 3.09, 5.67, 2.41, and 2.67, respectively. While analyzing statistically, it was seen that there was a significant decrease in the value of spirometric variables in the presence of dentures. Chronic denture wearer edentulous patients are subjected to the risk of development of spirometric alterations. Hence, these patients should be given timely instructions about the various respiratory exercise protocols.¹³ Piskin B et al, a total of 46 complete denture wearers were included in this study. Respiratory functions of the subjects were evaluated by spirometric tests that were performed in four different oral conditions: without dentures (WOD), with dentures, lower denture only and upper denture only. Forced vital capacity (FVC), peak expiratory flow, forced expiratory volume in 1 s and forced expiratory flow between 25% and 75% were evaluated. In all spirometric parameters, the most important significant differences were found between conditions WOD, FVC and with lower dentures (FVC), and WOD (forced expiratory volume in 1 s) and with upper dentures (forced expiratory volume in 1 s) ($p < 0.001$). It was observed that complete dentures may unfavourably affect spirometric values of edentulous subjects. However, current findings need to be confirmed with advanced respiratory function tests.¹⁴ Indrakumar HS et al, a spirometric assessment of the effect of complete dentures on respiratory performance was done. A total of 100 subjects were included, and diagnostic spirometer was used for carrying out the spirometric test at different stages of each subject. The spirometric test was carried out at four different stages: In the absence of both the denture (AODs), with both the dentures (maxillary and mandibular) inserted in the patient's mouth (BDs), with only maxillary denture inserted in the oral cavity (UDs), and finally, by inserting only the mandibular dentures in the oral cavity (LDs). Of the total 100 subjects included in the study, 42 were males and 58 were females. The mean FVC values of AOD, BD, LD, and UD group were

3.10, 3.02, 2.90, and 2.93 respectively. The mean PEF values of AOD, BD, LD, and UD group were 5.79, 5.60, 5.40, and 5.48 respectively; 2.39, 2.35, 2.33, and 2.32 were the mean FEV1 values observed in AOD, BD, LD, and UD group respectively. Statistically significant results were obtained while comparing AOD-FVC and BD-FVC and other oral conditions. Spirometric values of respiratory functional tests in edentulous patients might be unfavorably affected by wearing complete dentures.¹⁵ Saini R.S et al, 20 subjects with presence complete edentulous arch and who had history of complete denture usage for atleast five years were enrolled. Spirometric testing was carried out at following steps: Phase 1: Testing in absence of denture, Phase 2: Testing in presence of both dentures, Phase 3: Testing in presence of maxillary denture only; and Phase 4: Testing in presence of mandibular dentures only. FVC value, PEF value, FEV1 value and FEF25–75 value was recorded with the spirometric test. While analysing statistically, it was seen that there was significant decrease in value of Spirometric variables in the presence of dentures. Denture wearer edentulous patients are subjected to risk of development of Spirometric alterations.¹⁶

CONCLUSION

There was a significant decrease in the value of spirometric variables in the presence of dentures.

REFERENCES

1. Scannapieco FA, Ho AW. Potential associations between chronic respiratory disease and periodontal disease: Analysis of National Health and Nutrition Examination Survey III. *Journal of Periodontology*. 2001;72(1):50–6.
2. Scannapieco FA, Bush RB, Paju S. Associations between periodontal disease and noscomial pneumonia and chronic obstructive pulmonary disease. A systematic review. *Annals of Periodontology*. 2003;8:54–69.
3. Khadka S, Khan S, King A, Goldberg LR, Crocombe L, Bettiol S. Poor oral hygiene, oral microorganisms and aspiration pneumonia risk in older people in residential aged care: a systematic review. *Age and Ageing*. 2021;50(1):81–7.
4. Zeng XT, Tu ML, Liu DY, Zheng D, Zhang J, Leng WD. Periodontal disease and risk of chronic obstructive pulmonary disease: A meta-analysis of observational studies. *Plos One*. 2012;7(10):e46508.
5. Vogelmeier CF, Criner GJ, Martinez FJ, Anzueto A, Barnes PJ, Bourbeau J, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive lung disease 2017 Report. *American Journal of Respiratory and Critical Care Medicine*. 2017;195(5):557–82.
6. Ding B, Small M, Bergstrom G, Holmgren U. COPD symptom burden: impact on health care resource utilization, and work and activity impairment. *International Journal of Chronic Obstructive Pulmonary Disease*. 2017;12:677–89.
7. Mohamed GF. Clinical evaluation of the efficacy of soft acrylic denture compared to conventional one

- when restoring severely resorbed edentulous ridge. *Cairo Dent J.* 2008;24:313–23.
8. Choi JK, Hur YK, Lee JM, Clark GT. Effects of mandibular advancement on upper airway dimension and collapsibility in patients with obstructive sleep apnea using dynamic upper airway imaging during sleep. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010;109:712–9.
 9. Jones NL, Jones J, Edwards RHT. Exercise tolerance in chronic airway obstruction. *Am Rev Respir Dis.* 1971;103:477–491.
 10. Pontoppidan H, Geffin B, Lowenstein E. Acute respiratory failure in the adult. *N Engl J Med.* 1972;287:690–698.
 11. Ogata H, Hirakawa Y, Matsumoto K, Hata J, Yoshida D, Fukuyama S, et al. Trends in the prevalence of airflow limitation in a general Japanese population: two serial cross-sectional surveys from the Hisayama Study. *Bmj Open [Internet].* 2019. Jun; 9(3).
 12. Kelly N, Gormley K, Linden DA, Winning L, McClory M, Lundy FT, Cullen KM, Linden GJ, El Karim IA. The association of denture wearing with reduced lung function and increased airflow limitation in 58-72 year old men. *PLoS One.* 2023 May 18;18(5):e0285117.
 13. Shah Bukhari JA, Sudan S, Bangar B, Kumar N, Bhatia P, Duggal R. Assessment of the Effect of Complete Dentures on Respiratory Performance: A Spirometric Analysis. *J Pharm Bioallied Sci.* 2021 Jun;13(Suppl 1):S440-S443.
 14. Piskin B, Sipahi C, Karakoc O, Atay A, Ciftci F, Tasci C, Akin H, Arisan V, Sevketybeyoglu H, Turker T. Effects of complete dentures on respiratory performance: spirometric evaluation. *Gerodontology.* 2014 Mar;31(1):19-24.
 15. Indrakumar HS, Venkatesh D, Adoni VV, Kashyap R, Jayanthi D, Prakash N. Spirometric Assessment of Impact of Complete Dentures on Respiratory Performance: An in vitro Study. *J Contemp Dent Pract.* 2018 Feb 1;19(2):177-180.
 16. Saini, R. S., & Kaur, K. (2022). Analysis of impact of complete dentures on respiratory performance: An observational study. *International Journal of Health Sciences*, 6(S8), 937–941.