UDC: 616.314–77:612.24–072.7

IMPACT OF COMPLETE REMOVABLE DENTURES ON THE RESPIRATORY TRACT AIRFLOW

ВЛИЈАНИЕ НА ТОТАЛНИТЕ ПРОТЕЗИ ВРЗ ПРОТОКОТ НА ВОЗДУХ ВО РЕСПИРАТОРНИОТ ТРАКТ

Tanturovski F.[1], Bajevska J.[2]

[1]Dental Clinic Dentin – Skopje, North Macedonia, [2]Deparment of Prosthetics, Faculty of Dental Medicine, 'Ss. Cyril and Methodius" University, Skopje, North Macedonia

Abstract

Prosthetic restoration performs its function properly only if it fits with all other components that contain the masticatory organ. **The aim of** this paper is to determine the effect of complete removable dentures on the respiratory tract airflow through the process of spirometry. In our study, we used spirometry (measurement of respiration), which is the most common test for lung function, especially the amount (volume) and/or speed (flow) of air that can be inhaled and exhaled. The tests were performed on 8 patients with complete removable dentures who were healthy individuals. Spirometry was used as a method of work at the Institute of Medical Physiology and Anthropology at the Medical Faculty, "Ss. Cyril and Methodius" University in Skopje. Examinations were performed in different oral conditions: when both prostheses were present, when only the upper prosthesis was present, when only the lower prosthesis was present, and when both prostheses were not present in the oral cavity. The research was done to see if total dentures have an effect on airflow in the airway, or if their presence has an effect on the normal functioning of the respiratory tract. **Keywords:** complete removable dentures, spirometry, respiratory tract.

Апстракт

Протетската реставрација правилно ја врши функцијата само ако е вклопена со сите останати компоненти кои го сочинуваат џвакалниот орган. **Целта** на овој труд е да се одреди влијанието на тоталните протези врз протокот на воздух во респираторниот тракт преку процесот на спирометрија. Во нашава студија користиме спирометрија (мерење на дишењето), која претставува најчест тест за функцијата на белите дробови, посебно на количината (волуменот) и/или брзината (протокот) на воздух кој може да се вдишува и издишува. Испитувањата се изведени кај 8 пациенти кои носат тотални протези и се здрави индивидуи. Како метод за работа се користеше спирометрија при Институтот за медицинска физиологија и антропологија при Медицинскиот факултет, Универзитет „Св. Кирил и Методиј" Скопје. Испитувањата се изведуваа во различни орални состојби: кога се присутни двете протези, кога е присутна само горната протеза, кога е присутна само долната протеза, и кога не се присутни протезите во усната празнина. Истражувањето беше направено со цел да се воочи дали тоталните протези имаат влијание врз протокот на воздух во дишните патишта, односно дали нивното носење има влијание врз нормалното функционирање на респираторниот тракт. **Клучни зборови:** тотални протези, спирометрија, респираторен тракт.

Introduction

A dental prosthesis is a therapeutic tool that treats the consequences of lost teeth, and its task is not only to establish chewing, aesthetic, and phonetic rehabilitation but also to prevent harmful effects caused by the prosthesis of living tissue and mucous membranes. If we bear in mind the prophylactic property of the prosthesis, the modern prosthetist should also take care of the basic set of general medicine, which also applies to dentistry, and that is "primum non nocere", i.e. with the prosthetic treatment, the patient must not be harmed in the first place.

The prosthesis is a foreign body that necessarily causes some tissue damage. The prophylactic task is to minimize the harmful effects, although with today's knowledge it is still not possible to prevent it[1].

Today, the dental prosthesis is expected to be a therapeutic tool that will treat the effects of lost teeth and will establish the function of chewing, swallowing, phonation, aesthetics, and normal breathing, thus preventing damage on living tissues. In other words, if the prosthesis is poorly made prophylactically, hygienically, or with lack of laboratory skills, it will adversely affect the surrounding tissues.

Spirometry is just one of the diagnostic methods for measuring lung function (respiratory tract). It measures static and dynamic lung volume and flow capacities (vital capacity - VC, forced vital capacity - FVC, forced expiratory volume in 1 second - FEV1, Tiffany's index –

FEV1/FVC, peak expiratory flow PEF, forced expiratory flow on 25% of FVC - FEF75, forced expiratory flow on 50% of FVC – FEF50, forced expiratory flow on 75% of FVC - FEF25[2]. Spirometry measurement has an appropriate quality control protocol and proper standards, the last of which is published and is the current standard for performing spirometry measurements. These measurements are performed under the same conditions, using the same spirometer. Spirometer calibration is required daily due to surrounding factors (room temperature, air pressure, relative humidity), which would correct the measured volume in standard conditions (BTPS standard)[3]. Before testing, it is necessary to obtain information about the patient's gender, age, body height, and weight, which are then compared to individual standards (the respondent's expected values). That standard is embedded into the spirometer and does not need to be calculated, because the device automatically calculates it. Today, the European Coal and Steel Community (CECA II) standard is the most commonly used[4].

After entering the appropriate patient data in the spirometer (gender, age, weight, and height), the patient should stand upright and comfortably. The laboratory technician explains the need and the method of performing the test by demonstrating the correct technique for performing the test. Several tests (drills) are performed with the patient until he/she masters the correct technique, required for a properly performed spirometry. The patient should be encouraged to complete the exhalation process. In this procedure, it is important to limit the number of trials (drills and actual measurements) to 8 or less, to avoid exhaustion of the patient and improperly obtained results.

Spirometry is measured by deep exhalation, deep inhalation, and deep exhalation again through the pipe of the spirometer. This is repeated 3 times. The air must not escape through the nose, so patients are pinched on the nose with a nose clip.

During each measurement, the technique for each patient should be evaluated to avoid the appearance of an artifact in the final results. Possible artifacts include: insufficient or incomplete inhalation, shortness of breath during exhalation, additional inhalation during exhalation, unsatisfactory closing of the mouth, slow onset of exhalation, temporary cessation of exhalation, part of nasal exhalation, coughing during the first second of exhalation, etc. Technically, satisfactory spirometry measurement should be done three times. Those three measurements should be consistent (reproductive). Two of those should not differ more than 100 mL (for FVC and FEV1), i.e. 150 mL from each other. When 3 satisfactory measurements are made, the one with the highest number of FVC and FEV1 is selected, and it is later used for interpretation (compared to the individual standard) to calculate the percentages of the expected values for that person (measured value/standard (expected value) x 100%). The calculated percentage, thus serves as clinical estimate of spirometry measurements[3, 5].

Purpose of the paper

The aim of this paper is to determine the effect of complete removable dentures on the respiratory tract airflow of their carriers through spirometry evaluation.

Materials and methods

Tests were performed on 8 patients with complete removable dentures. Patients were selected at their regular check-up at the Department of Fixed and Removable Dental Prosthodontics at the PHO Dental Clinical Center "St. Pantelejmon", and we were guided by certain criteria, which were:

- Patients with complete tooth loss;
- Patients with complete removable dentures;
- Patients wearing the complete removable dentures for less than 5 years;
- Patients did not complain about existing dentures (wear them daily);
- There were no errors in the production of existing prostheses;
- Patients do not smoke;
- Patients do not to suffer from any respiratory diseases, such as asthma or chronic obstructive pulmonary disease;
- Patients do not have any cardiovascular or other systemic diseases.

Spirometry was used as a working method for this paper at the Institute of Medical Physiology and Anthropology at the Medical Faculty, University "St. Cyril and Methodius" Skopje. The required parameters for our study were: forced vital capacity - FVC, peak expiratory flow - PEF, forced expiratory volume in 1 second - FEV1, forced expiratory flow 25-75% - FEF25-75. Patients were sent to the Institute of Medical Physiology, where they rested for 5 minutes and were placed in a chair next to the spirometer. The laboratory technician gave them instructions on how to perform the test properly. The patient data (ordinal number, name, surname, date of birth, height, weight) were registered. Next was the placement of a nose clip on the nose. After

3 seconds the spirometer was set. The pipe of the spirometer was then placed in the mouth and the patient breathed normally several times, then he/she exhaled maximally, inhaled maximally, and exhaled rapidly and vigorously. This procedure was repeated three times in the same order, and each patient stood in an upright position. Results were printed on paper suitable for the spirometer.

These measurements were repeated in four oral conditions, with both total prostheses in the mouth, only the upper complete denture, only the lower complete denture, and without dentures in the mouth (as a control group).

Results

The results obtained from the research set as aims for the realization of our paper, are shown in the following tables and graphs. In this study, we used the correlation coefficient and the Chi square test of independence with significance level p=0.05. The null hypotheses of this study states that complete removable dentures do not affect the respiratory capacity in their carriers.

The control group comprises patients without complete removable dentures.

This table shows the number of respondents and their average age.

Table 1. Average values of the respondents classified by gender

GENDER	NUMBER OF PATIENTS	AGE
MALE	4	73.25
FEMALE	4	74.30
TOTAL/AVERAGE	8	73.76

The following tables show the values obtained during the spirometry analysis in female patients

Table 2. Values of each parameter from the spirometry analysis at different examined oral conditions for the **first female patient**

Spirometry (Spirometer parameter)	Condition in the oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	3.04	3.40	3.28	3.32
FEV1	2.96	3.12	3.00	3.08
PEF	4.10	3.63	3.45	3.86
MMEF 25/75	3.27	3.33	2.78	3.31

Table 3. Values of each parameter from the spirometry analysis at different examined oral conditions in the **second female patient**

Spirometry (Spirometer parameter)	Condition in the oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	3.60	1.40	1.92	4.60
FEV1	1.72	1.20	1.76	1.92
PEF	1.77	1.48	1.82	1.96
MMEF 25/75	1.35	3.51	1.68	1.44

Table 4. Values of each parameter of the spirometry analysis at different examined oral conditions in the **third female patient**

Spirometry (Spirometer parameter)	Condition in the oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	1.84	1.96	1.72	1.88
FEV1	1.60	1.76	1.52	1.64
PEF	1.76	2.01	1.84	1.85
MMEF 25/75	1.39	1.55	1.31	1.38

Table 5. Values of each parameter from the spirometry analysis at different examined oral conditions for the **fourth female patient**

Spirometry (Spirometer parameter)	Condition in the oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	4.88	1.44	2.12	2.56
FEV1	2.60	1.22	1.79	2.48
PEF	3.60	2.39	3.08	3.01
MMEF 25/75	0.73	3.76	2.68	2.70

The following tables show the values obtained during spirometry analysis in male patients.

Table 6. Values of each parameter from the spirometry analysis at different examined oral conditions for the **first male patient**

Spirometry (Spirometer parameter)	Condition in the oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	3.52	4.36	3.80	3.32
FEV1	3.32	4.48	3.60	3.28
PEF	3.85	7.29	5.59	5.98
MMEF 25/75	2.90	6.83	4.68	3.74

Table 7. Values of each parameter from the spirometry analysis at different examined oral conditions for the **second male patient**

Spirometry (Spirometer parameter)	Condition in the oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	4.00	3.04	3.96	4.04
FEV1	3.44	2.16	2.88	2.72
PEF	3.67	2.32	3.09	3.08
MMEF 25/75	3.18	2.72	2.46	2.72

Table 8. Values of each parameter from the spirometry analysis at different examined oral conditions for the **third male patient.**

Spirometry (Spirometer parameter)	Condition in the oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	2.40	2.16	2.48	2.32
FEV1	2.32	2.12	2.44	2.28
PEF	3.26	3.81	3.57	3.22
MMEF 25/75	1.87	1.81	2.40	1.56

Table 9. Values of each parameter from the spirometry analysis at various examined oral conditions for the **fourth male patient**

Spirometry (Spirometer parameter)	Condition in the oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	2.32	1.32	2.08	2.68
FEV1	2.08	1.98	2.04	2.52
PEF	2.20	2.25	2.48	3.67
MMEF 25/75	1.82	8.32	2.24	3.15

Table 10. Average values of spirometry parameters for the male respondents

Spirometry (Spirometer parameter)	Average spirometric analysis in the appropriate oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	3.06	2.72	3.08	3.09
FEV1	2.79	2.69	2.74	2.70
PEF	3.25	3.92	3.68	3.99
MMEF 25/75	2.44	4.92	2.95	2.79

Table 11. Average values of spirometry parameters for the female respondents

Spirometry (Spirometer parameter)	Average spirometric analysis in the appropriate oral cavity			
	With both prostheses	Without both prostheses	Without upper denture	Without lower denture
FVC	3.34	2.05	2.26	3.09
FEV1	2.22	1.83	2.02	2.28
PEF	2.81	2.38	2.55	2.67
MMEF 25/75	1.69	3.04	2.11	2.21

The following tables show the results obtained from our analysis.

Table 12. - for FVC (measurement of lung size (in liters) which is the air volume in the lungs that can be exhaled after previous deep inhalation).

	Number of patients	Min	Max	Arithmetic mean	Median	Variance	Standard Deviation		Correlation Coefficient
Without dentures (control group)	8	1.32	4.36	2.46	2.46	0.75	0.87		
With dentures	8	1.84	4.88	3.16	3.48	0.72	0.85	0.15	0.21
With lower denture	8	1.72	3.96	2.63	2.56	0.53	0.73	0.61	0.97
With upper denture	8	1.88	4.60	3.25	3.43	0.66	0.81	0.28	0.39

When the correlation coefficient is less than ("<") 0.5, it is interpreted that the data measured for the control group compared to the measured data for each of the other three cases (with prostheses, lower prosthesis, upper prosthesis) are poorly correlated.

If the correlation coefficient is greater than or equal to ("≥") at 0.5, the data from the control group compared to the data from each of the three cases separately (with prostheses, lower prosthesis, upper prosthesis) are statistically significantly correlated.

If the correlation coefficient is equal to ("=") to zero ("0"), the measured data from the control group are not in correlation with the measured data for each of the three cases in the oral cavity separately.

Table 12 shows that the correlation coefficient is low in the presence of the two prostheses in the oral cavity and the presence of the upper total prosthesis only, which indicates that their connection is very weak, almost insignificant and has no effect on respiratory capacity when the parameter FVC is considered. In the cases when only the lower prosthesis is present, the correlation coefficient indicates a statistically significant connection, which can be interpreted that the presence of the lower prosthesis in the oral cavity when performing spirometry analysis for the FVC parameter is associated with the respiratory capacity but does not necessarily mean that it has a direct impact on respiratory capacity.

The results of the arithmetic mean and the median, table 12, and the proximity of their values, indicate symmetry of the distribution of measured data for each state for the FVC parameter. The data measured for FVC are close to symmetrical distribution given the fairly close values of median and arithmetic mean and the data are symmetrically distributed in the absence of the complete removable dentures from the oral cavity.

The values of the arithmetic mean and the median, table 13, with the closeness of their values indicate symmetry of data distribution, which allows for them to be easily processed and facilitates the connection analysis. Data measured for the FEV1 parameter are precisely symmetrically distributed with removed dentures from the oral cavity and with only lower dentures in the respondents. For the other two oral conditions, data is quite close to their symmetry.

For the FEV1 parameter (table 13), the correlation coefficient demonstrates that there is a statistically significant relationship between the condition with complete removable dentures in the oral cavity and the condition without dentures in the oral cavity. It can be noted that each condition in the oral cavity (with dentures, only the upper or only the lower removable denture) is related to the respiratory capacity, but does not necessarily mean that they directly affect respiration regarding the FEV1 parameter.

The correlation coefficient (table 14) points out that there is a statistically significant connection between the examined data regarding the PEF parameter and each of the conditions in the oral cavity (with prostheses, only with upper or only with lower denture) is significant when associated with the respiratory capacity, but we cannot conclude that it has a direct impact on it.

Regarding the values of the arithmetic mean and the median from the table, the closeness of their values indicates symmetry of data distribution, i.e. data measured for the PEF parameter is precisely symmetrically distributed when there is only the upper and only the upper prosthesis in the oral cavity. For the other two oral conditions data is quite close to their symmetry.

Table 15 shows that the correlation coefficient is low, which leads to the conclusion that data are poorly relat-

Table 13. - FEV1 parameter (a measure of how much air can be exhaled in one second after previous deep inhalation).

	Number of patients	Min	Max	Arithmetic mean	Median	Variance	Standard Deviation		Correlation Coefficient
Without dentures (control group)	8	1.20	4.48	2.37	2.37	0.72	0.85		
With dentures	8	1.60	3.44	2.50	2.62	0.31	0.56	0.32	0.67
With lower denture	8	1.52	3.60	2.32	2.32	0.38	0.61	0.47	0.89
With upper denture	8	1.64	3.28	2.50	2.66	0.22	0.47	0.32	0.79

Table 14. - PEF parameter (individual maximum air exhalation speed. Typically this is measured in liters per minute (L/min).

	Number of patients	Min	Max	Arithmetic mean	Median	Variance	Standard Deviation		Correlation Coefficient
Without dentures (control group)	8	1.48	7.29	3.06	2.73	2.14	1.46		
With dentures	8	1.76	4.10	3.10	3.45	0.73	0.86	0.84	0.67
With lower denture	8	1.82	5.59	3.11	3.11	0.77	0.88	1.16	0.90
With upper denture	8	1.85	5.98	3.37	3.37	0.83	0.91	1.16	0.87

Table 15. - MMEF 25/75 parameter (medium forced expiratory flow between 25% and 75% of FVC, which in turn is interpreted as a quantitative measure of small obstructions (<2 mm) in the airways. It can be given in discrete periods, generally defined with how much of the FVC is exhaled)

	Number of patients	Min	Max	Arithmetic mean	Median	Variance	Standard Deviation		Correlation Coefficient
Without dentures (control group)	8	1.55	8.32	5.84	4.09	7.30	2.70		
With dentures	8	0.73	3.27	2.05	2.06	1.37	1.17	1.46	0.46
With lower denture	8	1.31	4.68	2.57	2.57	0.54	0.74	0.48	0.24
With upper denture	8	1.38	3.74	2.55	2.85	0.54	0.73	0.99	0.50

ed to each other. Concerning the MMEF 25/75 parameter, none of the different conditions in the oral cavity (with prostheses, only the upper or only the lower denture) has an effect on respiratory capacity.

Regarding the values of the arithmetic mean and the median, (table 15), the closeness of their values indicates the symmetry of data distribution, i.e. data measured for the MMEF 25/75 parameter is precisely symmetrically distributed when there is only the lower prosthesis and when the dentures are present in the oral cavity. For the other two oral conditions, data is quite close to their symmetry.

To show whether oral conditions have an impact or not on respiratory capacity, a zero hypothesis was formulated and tested using the Chi square test of independence. The value d is the result obtained for the x2 test when comparing the control group with each of the three conditions in the oral cavity for each of the four parameters. It is then compared to the value of the Chi square test (24.996). In all cases the value $d \leq 24.996$ from which we draw the conclusion that the tested null hypothesis is accepted, i.e. oral conditions do not affect the respiratory capacity of their carriers for each of the four parameters.

We selected the level of significance ourselves and it can receive a value in the range of 0-100%. We selected our level of significance to be 0.05. In practice, this means that there is a 5% probability that a connection

Table 16. - Zero hypothesis tested with X2 independence test

	FVC	FEV_1	PEF	MMEF 25/75	Degree of freedom	Significance level α=	The critical value of the test
	Result of the statistical test d						
With both dentures	8.00	13.33	6.27	3.73	15	0.05	≤ 24.996
Only with lower denture	18	14.67	11.20	4.18	15	0.05	
Only with upper denture	10	12.44	10.08	2.89	15	0.05	

(impact) has been observed between the compared data, i.e. in our case there is a 5% probability that the effect of complete removable dentures on respiratory capacity will be observed. The critical value of the Chi quadratic test is likely to result from a statistical test if the null hypothesis is correct. In our case, the critical value is 24.996. If it is greater than the results obtained for the statistical test d ($d \leq 24.996$), then the null hypothesis is accepted. This means that the probability of the occurrence of such a result, d, for the statistical test is higher than the selected level of significance, i.e. $p > 0.05$.

Since all d values obtained for the statistical test are less than 24.996, we conclude that the hypothesis is accepted, i.e. oral conditions do not affect the respiratory capacity of their carriers for each of the four parameters.

Discussion

Previous studies have shown that there is a strict relationship between the oropharyngeal condition and the upper respiratory tract[6-11]. However, until the end of the twentieth century, there were no clinical findings to assess respiratory function in a variety of dental conditions, such as for example partial or total tooth loss (edentulism). The most significant clinical records for the relationship between the oral condition and the respiratory function appeared only in the late 1990s.

Bucca et al.[12] reported that the Apnea-Hypopnea Index (AHI) presented almost doubled results during sleep in patients with complete tooth loss in contrast with those who did not wear dentures. Patients were 44 years old and they had obstructive sleep apnea (OSA) and chronic obstructive pulmonary disease (COPD). They wore complete removable dentures due to tooth loss and extraction. Cephalometric analysis of the patients revealed a significant narrowing of the antero-posterior oropharyngeal distance from 1.5 to 0.6 cm. After these significant findings, they expanded their studies to six male patients with OSA, and the authors noted that removing the complete prostheses significantly reduced the retropharyngeal space and that sleeping with prostheses removed from the mouth was associated with lowering the middle and lower arterial blood saturation, as well as an increase in the AHI index[12]. The authors concluded that removing the complete prostheses significantly reduced the retropharyngeal distance in OSA patients during sleep, and they advised patients not to remove their total prostheses while sleeping to avoid the risk of upper airway collapse[12, 13].

Also, in one study aimed to assess the impact of complete removable prostheses on the AHI index in 34 OSA patients, Ariska et al.[14] found that wearing the complete removable dentures reduced the AHI index in 19 patients while increased the index in 8 patients during sleep. Interestingly, the improvement in the AHI index is not related to a reduction in sleep apnea results, but to a reduction in hypopnea results. In addition, there was no significant difference between different prosthetic situations (with prostheses and without prostheses in the mouth) regarding the mean and low SpO_2 index and the desaturation index.

The results of this study are consistent with our results showing no effect on reducing the airflow in patients with various prosthetic situations (with dentures and without dentures in the mouth).

In another study, Bucca et al.[15] performed spirometry tests on 76 edentulous patients, of whom 36 were asymptomatic, 22 had chronic obstructive pulmonary disease (COPD), and 18 had interstitial lung disease

(ILD). These tests were performed to determine the effect of total prostheses on respiratory function. In addition, they reported that in asymptomatic patients and ILD patients, lung performance improved slightly when total dentures were in the patients' mouths. The authors added that, so far, no significant differences have been found in COPD patients in terms of whether they wore dentures or not in their mouth. According to Bucca et al.[12], the values of maximum expiratory flow (MEF), forced inspiratory flow at 50% (FIF50), and forced expiratory flow at 50% (FEF50) increased in asymptomatic patients, while peak eccentricity flow (PEF) and forced expiratory flow (FEF50) increased in ILD patients. There was no significant difference in the forced vital capacity (FVC) and the forced expiratory volume of 1% (FEV1) in any group of patients.

Compared to this study, asymptomatic patients, such as those in our study, were found to have better results with the presence of dentures in the oral cavity, which did not correspond to our results where we found that dentures had no effect on respiratory capacity. In contrast to previous studies. Almeida et al.[16] performed a polysomnographic evaluation of 23 edentulous patients with OSA. They found that wearing complete removable dentures during sleep increased the AHI index in mild cases. The results of this study were consistent with those of Almeida et al. However, comparing the two tests, subjects should be considered to have different sleeping positions while performing polysomnography, as opposed to sitting upright in a standard spirometry test.

Based on previously considered studies, the highest average value was found in patients who performed measurements without prostheses in the oral cavity for each spirometry parameter. In addition, the lowest mean value was observed in patients who performed measurements with only the lower total prosthesis present in the oral cavity for FVC and FEV1. The lowest mean values for PEF were obtained in patients wearing only the lower complete removable prosthesis, while in patients with both prostheses in situ, the lowest mean values were obtained for FEF25-75. FEV1 and FVC values in patients who did not have the prostheses in their mouth, were significantly higher than those who wore both prostheses, and only the upper or only the lower prosthesis ($p < 0.05$).

The PEF value showed an insignificant difference between patients who did not wear dentures and patients who wore both dentures. However, values in patients who did not have prostheses in their mouths were significantly higher than those who wore only the upper prosthesis or only the lower prosthesis ($p < 0.05$).

In addition, values in patients who didn't wear total prostheses were significantly higher than in patients with only the upper prosthesis or only the lower prosthesis for the FEF 25-75 value ($p < 0.005$). There was no significant difference in patients who didn't wear any prostheses in the mouth and who wore only the lower total prosthesis ($p > 0.05$).

Comparison of spirometry values between no prostheses in the mouth and the other three different oral conditions with the presence of prostheses in the oral cavity showed that the greatest correlation was found between FVC values where there were no prostheses in the mouth and conditions where there was only a lower total prosthesis ($p < 0.001$), and between the values of FEV1 in conditions of absent total prostheses from the mouth and a condition where only the upper total prosthesis was present ($p < 0.001$). In all spirometry parameters, a high correlation was observed between patients without prostheses in the mouth and where both prostheses were present in the mouth, and also between patients with only the upper prosthesis present and the condition where only the lower prosthesis was in place. ($p < 0.001$, $r > 0.8$). All p values are lower than 0.001.

Conclusion

In this paper, we examined the problem of respiratory function in patients - carriers of total prostheses. The research was done to see if complete removable dentures have an effect on airflow in the airways, i.e. if their use has an effect on the normal functioning of the respiratory tract.

Our results, as well as the research conducted by other authors, show that in some individuals there was an effect of the complete removable prosthesis on the results of spirometry analyzes, whereas in others there was none.

With this data, it cannot be confirmed with certainty whether patients should remove the prostheses during examinations and at night, because the tests did not show any changes, and in some tests it showed improvement in performing the spirometry with prostheses in the mouth. As a result of the limitations of this study, further examinations are needed with a representative sample of responders and extended examinations to validate current findings.

Reference

1. M. Suvin. Bioloski temelji protetike – totalna proteza 1988; VII dopunjeno izdanje: 1 – 4
2. Chronic Obstructive Pulmonary Disease: National clinical guideline for management of chronic obstructive pulmonary disease in adults in primary and secondary care. Thorax 2004; 59 (Suppl. 1):1-232.

3. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, Crapo R, Enright P, van der Grinten CP, Gustafsson P, Jensen R, Johnson DC, MacIntyre N, McKay R, Navajas D, Pedersen OF, Pellegrino R, Viegi G, Wanger J. ATS/ERS Task Force. Standardisation of spirometry. Eur Respir J 2005; 26(2):319-38.
4. Quanjer PH, Tammeling GJ, Cotes JE, Pedersen OF, Peslin R, Yernault JC. Lung volumes and forced ventilatory flows. Report Working Party Standardization of Lung Function Tests, European Community for Steel and Coal. Official Statement of the European Respiratory Society. Eur Respir J 1993; 6 (Suppl. 16):5-40.
5. Hyatt RE, Scanlon PD, Nakamura M. Interpretation of Pulmonary Function Tests. A Practical Guide. Second Edition. Lippincot Philadelphia: Williams and Wilkins, 2003.
6. Solow B, Skov S, Ovesev J, et al. Airway dimensions and head posture in obstructive sleep apnea. Eur J Orthod 1996; 18:571 – 579.
7. Choi JK, Hur YK, Lee JM, et al. 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 Ednod 2010; 109:712 – 719.
8. Lowe AA, Gionhaku N, Takeuchi K, et al. Three dimensional CT reconstructions of tongue and airway in adult subjects with obstructive sleep apnea. Am j Orthod Dentofacial Orthop 1986; 90:364 – 374.
9. Clark GT, Arand D, Chung E, et al. Effect of anterior mandibular positioning on obstructive sleep apnea. Am Rev Respir Dis 1003; 147:624 – 629.
10. Muto T, Yamazaki A, Takeda S. A cephalometric evaluation of the pharyngeal airway space in patients with mandibular retrognathia and prognathia, and normal subjects. Int J Oral Maxillofac Surg 2008; 37:228 – 231.
11. Martin O, Muelas L, Vinasa MJ. Nasopharyngeal cephalometric study of ideal occlusions. Am J Orhod Dentofacial Orghop 2006; 130:436. El-436. e9.
12. Bucca C, Carossa S, Pivetti S, et al. Edentulism and worsening of obstructive sleep apnea. Lancet 1999; 353:121 – 122.
13. Bucca C, Cicolin A, Brussino L, et al. Tooth loss and obstructive sleep apnea. Respir Res 2006; 17:7 – 8.
14. Arisaka H, Sakuraba S. Tamaki K, et al. Effects of wearing complete dentures during sleep on the Apnea – hypopnea index. Int J Prosthodont 2009; 22:173 – 177.
15. Bucca C, Carossa S, Colagrande, et al. Effect of edentulism on spirometric tests. Am J respire Critr Care Med 2001; 162:1018 - 1020
16. Almeida FR, Furuayama RJ, Chaccur DC, et al. Complete denture wear during sleep in elderly sleep apnea patients-a preliminary study. Sleep Breath 2011; DOI: 10.1007/s11325-011-0587-9.