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THE INFLUENCE OF COMPLETE DENTURES ON XEROSTOMIA AND THE CONCENTRATION OF SALIVARY PROTEINS

ВЛИЈАНИЕ НА ТОТАЛНИТЕ ПРОТЕЗИ ВРЗ КСЕРОСТОМИЈАТА И КОНЦЕНТРАЦИЈАТА НА САЛИВАРНИ ПРОТЕИНИ

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Abstract

The **aim** of this study is to determine the severity of xerostomia and the concentration of total proteins and albumin in the saliva of edentulous individuals, before and after wearing complete dentures. To realization of the objective, the study included 50 subjects of both sexes aged 30-70 years. The sample of the subjects was divided into two groups. The first group, the experimental group, consisted of 25 edentulous subjects. The second group, the control group, consisted of 25 subjects who have at least 20 teeth. A questionnaire was carried out among all subjects, in which questions were primarily directed to determine the medical history of the patients and to estimate the subjective feelings of the patients associated with xerostomia. The collecting of the unstimulated saliva was performed using the Spitting method and total salivary proteins were determined with Biuret test (g/l), salivary albumin was determined with modified bromocresol test (g/l). Xerostomia is much more present among patients before the insertion of the complete dentures than after the insertion. There was no significant difference between the concentration of salivary proteins and albumins before the insertion of the dentures and the biochemical composition of the saliva, after the insertion of the complete dentures. **Key words**: complete dentures, xerostomia, salivary proteins.

Апстракт

Целта на овој труд е да се утврди изразеноста на ксеростомијата како и концентрацијата на вкупните протеини и албумин во плунката кај беззаби индивидуи пред и по тоталното протезирање. За реализација на поставената цел во испитувањето беа вклучени 50 испитаници од двата пола на возраст од 30-70 години. Примерокот на испитаници беше поделен на две групи. Првата група, експерименталната, ја сочинуваа 25 беззаби испитаници Втората група, контролната, ја сочинуваа 25 испитаници кои имаат најмалку 20 присутни заби во устата. Кај сите испитаници беше спроведен прашалник, во кој прашањата беа насочени пред се, да се утврди медицинската анамнеза на пациентите и да се процена субјективните чувства на пациентите поврзани со ксеростомија.Колекционирањето на нестимулираната плунка беше изведено со ***Spittingmethod (Метод со плукање)*** Вкупни саливарни протеини бра определувани со Биурет реакција (g/l) а албуминот со модифициран бромкрезол тест (g/l). Ксеростомијата е многу повеќе присутна кај пациентите пред поставување на тоталната протеза отколку по нејзиното поставување. Немаше значајна разлика помеѓу концентрацијата на саливарните протеини и албум пред поставувањето на протезите и биохемискиот состав на плунката по поставувањето на тоталите протези. **Клучни зборови**: тотална протеза, ксеростомија, саливарни протеини.

Introduction

The fabrication of complete dentures among edentulous individuals, and the oral healthcare are important for the overall health, especially for the elderly. Edentulous patients who do not have dentures, or have poorly made dentures, have a greater possibility of developing an oral mucosa disease, inadequate nutrition, respiratory, cardiac, or stomach disease. These problems are more impressive if the patient's age is more advanced.

Biological, physical and mechanical factors that improve the functional and aesthetic characteristics of complete dentures also influence the retention and stabilization of the dentures. Good retention of dentures is produced by using a valve effect, the strength of adhe-

sion, with mechanical retention which depends on the anatomical features of the jaws and proper placement of teeth. It should meet the rules of articulation and occlusal relations, to provide space for the tongue and satisfy aesthetics and phonation[2,3].

The problems associated with oral health among adults, which are constantly increasing in our country are becoming more serious with age. These problems include loss of teeth due to complications of periodontitis, abrasion and attrition of the teeth, the occurrence of root caries, xerostomia, taste disturbances, and difficulty in chewing and swallowing food[4,5,6].

Because of these problems, it is more likely for older individuals to have some sort of prosthetic appliances, usually complete or partial dentures. Celebic et al.[7] point out that patients with complete dentures are significantly more satisfied in achieving speech function, compared with patients who have partial dentures. Complaints of patients with complete dentures are more commonly associated with avoiding various types of food, while patients who wear partial dentures mainly complain of problems with retention of the dentures. Overall, more pleasure and satisfaction of dentures is registered in patients with complete dentures than in patients with partial dentures[8]. The pain which occurs in the improperly made dentures can be the reason for developing insomnia and a disruption of the eating habits. All this leads to diminished self-esteem of the person and its reduced activity in social life[9,10].

The retention of dentures greatly depends on the presence of saliva in the mouth. It is defined as the ability of the denture to resist the forces which tend to separate the denture from thebasis[11]. The successful rehabilitation of edentulous patients depends on the patient satisfaction with denture retention. Two important factors associated with the retention of the denture are: adequate and intimate fitting on the oral mucosa and an adequate valve edge[12]. Among other physical factors (adhesion, cohesion, surface tension, atmospheric pressure, and weight) that provide retention of the complete denture, saliva in adequate quantities and with an adequate composition is also an important physical factor that enables retention[12-14].

Xerostomia prevalence increases with age and is present in 30% of those aged over 65 years. Drugs are the most common cause of xerostomia, because most of the older people take at least one medication that has a negative influence on salivary function[15]. Patients with xerostomia may have problems while eating, speaking, and swallowing while wearing the dentures. Denture wearers can have problems with the retention of the dentures, occurrence of traumatic ulcers and sticking the tongue on the palate. Patients also complain of halitosis, chronic burning and intolerance to spicy food[16]. Xerostomia is more common at night, because the secretion of saliva is lowest during sleep. The problem increases if a habit of mouth breathing is present. Speaking and eating difficulties can disrupt the social interactions[17].

Ship et al.[18] and Mendoza et al.[19] point out that xerostomia is relatively common in edentulous patients, which makes the wearing of complete dentures extremely problematic. Several studies point out even extreme discomfort in complete denture wearers[18,19].

The aim of the study

The aim of this study is to determine the severity of xerostomia and the concentration of total proteins and albumin in the saliva of edentulous individuals, before and after wearing a complete denture.

Material and methods

The study included 50 subjects from both genders aged from 30 – 70 years divided into two groups.

The first group, the experimental one, in need of complete dentures was consisted of 25 edentulous patients, admitted at the UDCC St Pantelejmon – Department for removable dentures in Skopje.

The second group, the control group, consisted of 25 subjects who had at least 20 teeth present in the mouth. These subjects were recruited at the University Dental Clinical Centre in Skopje.

A questionnaire was carried out among all subjects, in which questions were primarily directed to determine the medical history of the patients and to estimate the subjective feelings of the patients associated with xerostomia. This study excluded (either from the experimental or the control group) smokers, alcoholics, pregnant women, individuals with salivary glands surgery, individuals after radiation therapy in the head and neck area, individuals suffering from Sjögren's syndrome, diabetes, rheumatoid arthritis, or lupus erythematosus and individuals who took medications that affected the secretion of saliva.

Special questionnaires were made for determining the level of expression of xerostomia. The study used the questionnaire recommended by **Carda**, 2006[20].

Question A: Have you had a feeling of dryness in the mouth in the last 6 months? Yes/No

Question B: How much saliva is there in your mouth? A bit/Enough/ A lot

Question C: Do you have difficulty in swallowing food? Yes/No

Question D: Do you have a need to take fluids in order to make the food swallowing easier? Yes/No

The level of expression of xerostomia was determined based on the answers to these questions:

Xerostomia 1 (mild): When the answer is positive only under question A

Xerostomia 2 (moderate): When there is a positive answer under question A and another positive answer (B, C or D)

Xerostomia 3: (severe): When there is a positive answer under question A and two other (B, C or D)

For determining the total salivary proteins and albumin, from all the subjects of both the control and experimental group, we collected total unstimulated saliva under the recommendations of Navazesh[21] for a period of 10 minutes. The subjects were advised one hour before the collection of saliva not to eat, smoke, or drink coffee, tea or to brush their teeth. The collection of saliva was performed in the same time of the day (10-11h) for all of the subjects.

The collecting of the unstimulated saliva was performed using the **Spitting method.**

The biochemical parameters in the saliva were determined in the biochemical laboratory of Surgical Clinics at the University Clinical Center "Mother Teresa" in Skopje, using a biochemical analyzer INTEGRA 400-Roche, including:

- Total salivary proteins – Biuret test (g/l)
- Albumin – modified bromocresol test (g/l)

All the tests listed were made only once for the control group, in the agreed term for the collection of the saliva.

The determining of the level of expression of xerostomia and the biochemical parameters in the saliva was carried out, during the first examination (before taking the primary impression for dentures) and during the control examination (one month after the patient received the dentures).

Results

Table 1: Distribution of the patients according to gender

EG/sex	number.	%
Male	12	48,0
Female	13	52,0
Total	25	100,0
CG/sex		
Male	12	48,0
Female	13	52,0
Total	25	100,0

The study included 50 examinees, who were divided into two groups. The examined group (EG) consisted of edentulous patients, for whom acrylic complete dentures were made. The second group was the control group (CG), consisted of 25 examinees who had at least 20 teeth in their mouth. Both groups were identical regarding the presence of gender, and the difference registered inside the same groups (48,0% and 52,0%) was statistically insignificant for p>0,05. It's a homogenous group (Table and Chart 1). The average age of patients in the experimental group was 58,4 ± 5,6 years and in the control group it was 58,1±9,4 years (Table 2). The difference registered between age, between the two groups was statistically insignificant for p>0,05 (Table 3).

Table2: Average age of the subjects from both examined groups

age	number	average	minimum	maximum	Std.Dev
EG*	25	58,4	49,0	67,0	5,551877
CG**	25	58,1	35,0	69,0	9,360021

Legend: *EG – examined group, **CG – control group

Table 3: Mann-Whitney U test

	Rank Sum	Rank Sum	U	Z	p-level
age	603.5000	671.5000	278.5000	0.659697	0.509449

Table 4: Representation of the level of xerostomia in both groups and in the examined group after the insertion of the complete dentures

EG-before the insertion of dentures/xerostomia	number	%
No xerostomia	3	12.0
mild	16	64.0
moderate	6	24.0
EG-after the insertion of dentures/xerostomia		
No xerostomia	18	72.0
mild	7	28.0
CG/xerostomia		
No xerostomia	22	88.0
mild	3	12.0

The level of xerostomia is more common among the patients from the examined group (mild xerostomia - 64,0% and moderate xerostomia 24,0%) in the pre-made period of the dentures, regarding the control group (mild xerostomia -12%) and after the insertion of the dentures (mild xerostomia -28,0%) (Table 4). The percentage difference registered between the absence of xerostomia in the examined group before and after the insertion of the dentures is statistically significant for $p<0,0001$. The percentage difference registered between the absence of xerostomia in the examined group before the insertion of dentures versus the control group is statistically significant for $p<0,0000$.

The percentage difference registered between the absence of xerostomia in the examined group after the insertion of the dentures versus the control group, is statistically insignificant for $p=0,1638$.

Table 5: Average value of total salivary proteins in the examined group before taking the primary impression, after insertion of the denture and in the control group

Total salivary proteins g/L	number	average	minimum	maximum	Std. Dev.
Before the insertion of dentures - EG	25	1,6	0,0	3,0	1,224745
After the insertion of dentures - EG	25	1,9	1,0	3,0	0,971253
Control group	25	1,5	0,0	4,0	0,871780

Table 6: Mann-Whitney U's test

Total salivary proteins g/L	Rank Sum	Rank Sum	U	Z	p-level
Between the EG before insertion of the dentures and the CG	645.0000	630.0000	305.0000	0.145521	0.884299
Between the EG after insertion of the dentures and the CG	574.0000	701.0000	249.0000	-1.23208	0.217920
EG before and after the insertion of dentures	590.0000	685.0000	265.0000	-0.921635	0.356719

Table 7: Average value of the albumin concentration in saliva in the examined group before taking of the primary impression, after dentures insertion and in the control group

Albumin in saliva g/L	number	average	minimum	maximum	Std. Dev.
Before dentures insertion EG	25	1,0	0,0	2,0	0.675771
After dentures insertion EG	25	1,2	0,0	2,0	0.707107
Control group	25	1,3	0,0	3,0	0.645497

Table 8: Mann-Whitney U's test

Total salivary proteins g/L	Rank Sum	Rank Sum	U	Z	p-level
Between EG before insertion and the CG	585.5000	689.5000	260.5000	-1.00895	0.313000
Between EG after insertion and the CG	626.5000	648.5000	301.5000	-0.213431	0.830991
EG before and after the insertion of dentures	579.5000	695.5000	254.5000	-1.12537	0.260435

The average value of total salivary proteins in the examined group before the denture insertion was 1,6±1,2 g/L, after the insertion was 1,9±1,0 g/L, while in the control group, it was 1,5±0,9 g/L (Table and graph 5).

According to Mann-Whitney U test, the registered difference between the average values of total salivary proteins in the examined group before and after dentures insertion, as well as in the control group, is statistically insignificant for p>0,05 (Table 6).

The average value of albumins in saliva in the examined group before the denture insertion is 1,2±0,7 g/L, while in the control group it is 1,3±0,6 g/L (Table 7).

According to the Mann-Whitney U test, the registered difference between the average values of salivary albumins in the examined group before and after the insertion of the complete dentures, as well in the control group is statistically insignificant for p>0,05 (Table 8).

Discussion

For many individuals the only solution for the complete loss of teeth is by fabricating complete dentures. By making the adequate dentures and with their proper maintenance and acceptance by the patient, it is expected for the main oral functions to be recovered.

The saliva has several important functions (protective, antimicrobial, digestive, reparatory, regenerative and as a buffer) by which it participates in maintaining the oral health [22,23,24].

The study included 50 subjects from both genders aged from 30-70 years divided into two groups. In order to get valid results, the examinees in both groups were approximately of the same age and gender. Also, as criteria for exclusion from the study, were listed all the conditions and diseases that affected the secretion of saliva and usually caused xerostomia.

Xerostomia caused by medications is an often problem, especially in the elderly patients because they take a lot of medications (antihistamines, antidepressants, antihypertensive medications, anxiolytics, diuretics etc) during the day that may have an impact on salivary glands function[18,25,26]. The irradiation of the head and neck region, diabetes, HIV, emotional stress, diseases of the salivary glands also may contribute to the occurrence of xerostomia[27]. The reason behind the exclusion of these diseases or conditions from the study is to determine the effect of complete dentures on salivation.

The level of xerostomia was more common among patients from the examined group. In fact, before the insertion of dentures we marked a very high level of xerostomia in about 64,0% of the patients in the examined group and 24,0% highly expressed xerostomia (moderate). Only 12% (3) of the control group examinees registered poorly expressed xerostomia (mild). One month after the insertion and wearing complete dentures, only 28% of examinees who belonged to the examined group, registered a poorly expressed xerostomia (Table 4).

The percentage difference between the registered absence of xerostomia in the examined group before the insertion of dentures versus the control group was statistically significant for p <0,0000. The difference between the registered absence of xerostomia in the examined group before the insertion and one month after, is statistically significant for p <0,0001. The percentage difference registered between the absence of xerostomia in the examined group after the insertion of the dentures versus the control group is statistically significant for p=0,1638. That means that, patients who wear complete dentures for one month, have their subjective feeling of dryness in the mouth significantly reduced.

Xerostomia means a subjective feeling of dryness in the mouth. This symptom is often present among patients in dental practice and it is confused with the term hyposalivation. Hyposalivation is defined as a decreased secretion of saliva. Not always, the subjective feeling of dryness in the mouth is followed by decreased secretion of saliva. The results from the examination showed that most of the edentulous patients noted lower or higher level of xerostomia. It is expected that edentulous patients are followed by this symptom of dry mouth because of the lack of mechanical stimulation for the secretion of saliva. The proper and normal salivation requires certain stimulations (mechanical, chemical and physical) of the receptors in the oral cavity. Among edentulous patients mechanical stimulations are missing the most, and because of that xerostomia is more common and visible. One month after wearing dentures, patients have the subjective feeling of dryness reduced, because complete dentures compensate the lost oral functions. Also, the masticatory function is re-established, and the stimulus number on the numerous mechanoreceptors and gustative receptors is increased.

Our results are consistent with the findings of Maheshwari[28], while in contrast with the findings of Bekiroglu[29] and Michael[30]. We assume that the differences in the results that we got were due to the differences that appeared in the examined groups. We must point out that our examinees were without systemic diseases and without any medical treatment that affects the secretion of saliva. On the other side, in Bekiroglu's[29] and Michael's[30] studies, the patients suffered from certain systemic diseases or received treatment which affected the salivary flow.

Some studies[31,32] determine the concentration of salivary proteins in patients with complete dentures. Usually salivary proteins among these patients are correlated with the occurrence of prosthetic stomatitis. The conclusion from these studies is that patients who have prosthetic stomatitis have an increased concentration of salivary proteins.

In the saliva there are many proteins, which are mainly descended from the acinus cells but some of them, such as the albumin, derives from the blood plasma. Most of the proteins in saliva are present in very small concentrations, but are important for maintaining the health of all the oral structures. The thing that is especially important for patients with complete dentures, related to salivary proteins, is the presence of a number of proteins (histatins, PRP and immunoglobulins, etc.) which have an antifungal role. It is proved that salivary histatin 5 with his effect destroys the fungus Candida albicans. During our research we determined the total salivary proteins and salivary albumins. The results from our study are the following: the average value of total salivary proteins in the examined group before the dentures insertion was 1,6 ± 1,2 g / L, after the insertion was 1,9±1,0 g/L, while in the control group the concentration of salivary proteins was 1,5 ± 0,9 g / L (Table and chart 22). The average value of albumin in the saliva in the examined group before the insertion was 1,0±0,7 g/L, after the insertion of the denture it was 1,2±0,7 g/L, while in the control group the result was 1,3 ± 0,6 g / L (Table and Chart 24).

During our study, we did not register significant changes in the concentration of total salivary proteins and albumin, before and after the dentures insertion. Also, there was not a significant difference between the concentration of total salivary proteins and albumins in the saliva of patients in the examined group and the concentration of total proteins and albumins in the control group. Our results are not in accordance with the results of Bencharit[32] and Byrd[31], who registered an increased concentration of salivary proteins among patients with total dentures. This difference that exists between our results and the results in the mentioned studies, is due to the fact that our patients wore the dentures for just a month and none of them had the manifestation of prosthetic stomatitis.

Based on the analysis of the results, we believe that complete dentures in edentulous patients have a significant influence on the salivary flow. Xerostomia is much more present among patients before than after the insertion of complete dentures. There was no significant difference between the concentration of salivary proteins and albumins before the insertion of the dentures and the biochemical composition of the saliva after the insertion of the complete dentures.

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