UNSTIMULATED AND STIMULATED SALIVATION IN PATIENTS BEFORE AND AFTER COMPLETE DENTURE REHABILITATION

НЕСТИМУЛИРАНА И СТИМУЛИРАНА САЛИВАЦИЈА КАЈ ПАЦИЕНТИ ПРЕД И ПО ТОТАЛНО ПРОТЕЗИРАЊЕ

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Abstract

Aim of the study: To determine the influence of new complete dentures placement on the amount of secreted unstimulated and stimulated saliva. **Material and Methods:** This study included 50 subjects of both sexes, aged 30-70 years. The subjects were divided into two groups: experimental - consisting of 25 edentulous subjects who came for fabrication of complete dentures; control group - consisting of 25 subjects with at least 20 teeth present in their mouth. We collected total unstimulated and stimulated saliva (spitting method) from all subjects from both groups, control and examined group, according to the recommendations by Navazesh. The collection of saliva in the control group was performed only once, and in the examined group on three occasions: before taking an anatomical impression for the fabrication of complete dentures, immediately after the placement of the complete dentures, and one month after dentures placement. The data were statistically processed using descriptive statistics, ANOVA, Mann Whitney U test, and Post-hoc Tukey HSD test. **Results:** There is a statistically significant difference in the amount of unstimulated and stimulated saliva between the patients from the control group and the patients from the examined group before the prosthodontic rehabilitation (p=0.000002; p=0.000005), as well as between the control group and the examined group immediately after the prosthodontic rehabilitation (p=0.000089; p=0.005206). There was not a statistically significant difference in the amount of unstimulated and stimulated saliva between the patients from the control group and the patients from the examined group 1 month after the prosthodontic rehabilitation (p=0.466855; p=0.748857). **Conclusions:** In edentulous patients, complete dentures have a significant impact on the salivary flow. Additionally, the amount of unstimulated and stimulated saliva increases significantly immediately after placing the dentures. After a certain period of adaptation, the salivary flow normalizes. There is no significant difference in the amount of secreted unstimulated and stimulated saliva between the patients, one month after wearing the dentures, and the subjects from the control group. **Key words:** Saliva, complete dentures, salivary flow.

Апстракт

Цел на трудот: Да се утврди влијанието на поставувањето на нови тотални протези врз количеството на излачена нестимулирана и стимулирана плунка. **Материјал и методи:** Истражувањето вклучи 50 испитаници од двата пола, на возраст од 30 до 70 години. Испитаниците беа поделени во две групи. Испитувана група – се состоеше од 25 беззаби испитаници кои имаа потреба од изработка на тотални протези; контролна група – се состоеше од 25 испитаници кои имаа најмалку 20 заби присутни во усната празнина. Колекциониравме вкупна нестимулирана и стимулирана плунка (со методот на исплукување) од сите испитаници, од контролната група, како и од испитуваната група, според препораките од Navazesh. Колекционирањето на плунка од контролната група беше изведено само еднаш, а кај испитуваната група во три наврати: пред земањето на анатомски отпечаток, по изработката и аплицирањето на тоталните протези и 1 месец по носењето на тоталните протези. Податоците беа статистички обработени, користејќи: дескриптивна статистика, ANOVA, Mann Whitney U test и Post-hoc Tukey HSD test. **Резултати:** Постои статистички сигнификантна разлика во количеството на излачена нестимулирана и стимулирана плунка помеѓу пациентите од контролната група и пациентите од испитуваната група пред протетската рехабилитација (p=0.000002; p=0.000005), како и помеѓу пациентите од контролната група и пациентите од испитуваната група веднаш по тоталното протезирање (p=0.000089; p=0.005206). Не постои статистички сигнификантна разлика помеѓу количеството на излачена нестимулирана и стимулирана плунка помеѓу пациентите од контролната група и пациентите од испитуваната група 1 месец по протетската рехабилитација (p=0.466855; p=0.748857). **Заклучок:** Тоталното протезирање на беззабите пациенти има сигнификантно влијание врз количеството на излачена плунка. Дополнително, количеството на излачена нестимулирана и стимулирана плунка сигнификантно се зголемува по предавањето на тоталните протези. По одреден период на адаптација, количеството на плунка се нормализира. Не постои статистички сигнификантна разлика во количеството на излачена нестимулирана и стимулирана плунка помеѓу пациентите 1 месец по носењето на тотална протеза и пациентите од контролната група. **Клучни зборови:** Плунка, тотални протези, количество на излачена плунка.

Introduction

The dramatic increase in the elderly population (over 60 years old) is associated with a period of life when people lose their teeth and wear complete dentures. As the length of life and the number and proportion of older people increase, in most industrialized and many developing nations, a central question is posed - whether the aging of this population will be accompanied by sustained or improved health, an improving quality of life, and sufficient social and economic resources[1]. The demographic data on population aging show that the need for rehabilitation of edentulous patients will remain considerable for many more decades. Conventional complete dentures are still a preferred treatment for edentulous patients, and this treatment modality improves oral health-related quality of life[2]. Edentulous patients have a higher risk of developing diseases of the oral mucosa, as well as a higher risk of developing: cardiovascular, gastrointestinal, endocrine, renal and other systemic diseases[3-9]. These problems are all the more pronounced as the age of the patient is more advanced[10].

The biological, physical and mechanical factors that improve the functional and aesthetic characteristics of complete dentures also have an impact on the retention and stabilization of the dentures. Good retention of complete dentures is obtained with the help of the valve effect, adhesion force, mechanical retention that depends on the anatomical characteristics of the jaws and the correct placement of the teeth. In doing so, the rules for occlusal and articulatory relations should be satisfied, space for the tongue should be provided, and aesthetics and phonation should be satisfied[11-16].

In older patients, it is not easy to ensure good retention of the dentures, due to uneven and rapid resorption of the alveolar ridge[17]. The retention of dentures not only depends on physical factors but is also related to the flow of saliva. The composition of saliva varies greatly in different individuals and in the same individual under different circumstances and stimulations[18]. Often, the reason for poor retention of complete dentures is insufficient amount of saliva in the mouth in adult individuals. The forces on which the retention of the dentures depends are divided into physical and physiological. Physiological forces, on the other hand, are related to the functions of the muscles of the face, lips and tongue[19]. From a functional point of view, the retention of dentures is determined by the balance between these two types of forces that change during speaking, chewing and swallowing[20].

The presence of an optimal amount of saliva in the mouth, with an appropriate consistency and quality, is especially important for edentulous patients, who require the fabrication of complete dentures. Prosthodontists should pay particular attention to the qualitative and quantitative characteristics of saliva before placing the dentures, during their production, and after placing the dentures[21].

Due to the fact that the literature indicates the importance, but also the association, between dental prosthetic rehabilitation and saliva, the aim of this study was to determine the influence of the placement of new complete dentures on the amount of secreted unstimulated and stimulated saliva.

Material and method

To realize the established goal, 50 subjects of both sexes, aged 30-70 years, were included in the study. The sample of subjects was divided into two groups:

- The first group, the experimental group, consisted of 25 edentulous subjects who came to the Clinic for Dental Prosthetics, at the PHI University Dental Clinical Centre "St. Panteleimon" in Skopje, for fabrication of complete dentures.
- The second group, the control group, consisted of 25 subjects who had at least 20 teeth present in their mouth. These subjects were also recruited at the PHI University Dental Clinical Centre "St. Panteleimon" in Skopje.

This study included patients who were in need of complete denture rehabilitation and patients who collaborated during the sample collection process.

Patients who smoke and/or drink alcohol, pregnant women, patients who have had surgical interventions of the salivary glands, patients who have had received head and neck irradiation, patients with Sjogren's syndrome, diabetes, rheumatoid arthritis, systemic lupus erythematosus and patients taking medications that affect the secretion of saliva, were excluded from this study.

The saliva collection was performed in the Biochemistry laboratory at the Ss. Cyril and Methodius University in Skopje, Faculty of Dentistry – Skopje, Department of Oral and Periodontal Diseases. We were collecting unstimulated and stimulated saliva from all subjects, both from the control and from the examined group, according to the recommendations by Navazesh[22], for 10 minutes. Subjects were advised not to eat, smoke, drink coffee, tea, coke, and brush their teeth one hour before saliva collection. Saliva collection was performed in the same period of the day (10-11h) for all subjects.

Collection of unstimulated saliva was performed by using the spitting method. Saliva accumulates on the floor of the oral cavity, and then the subject spits into a graduated tube every 60 seconds or whenever they get the urge to swallow the saliva accumulated on the floor

of the oral cavity. A funnel was also placed on the tube to facilitate the collection of saliva. For the collection of stimulated saliva, the gustatory stimulation method was used, 1-2 drops of lemon were dripped on the tip of the subject's tongue. At the moment when a sufficient amount of saliva had accumulated in the mouth, the subjects spat into a graduated test tube with a funnel.

We expressed the amount of saliva in milliliters for 1 minute. In this way, we obtained the values for the amount of saliva produced on average in one minute.

The collection of saliva in the control group was performed only once, and in the examined group on three occasions: before taking an anatomical impression for the fabrication of the complete dentures, immediately after the placement of the complete dentures, and one month after dentures placement.

The data were statistically processed using SPSS Statistica v20 for Windows, using the tests appropriate for the characteristics of the sample.

Results

This study included 50 subjects who were divided into two groups. The examined group (EG) consisted of edentulous patients, for whom acrylate complete dentures were made. The second group was the control group (CG), which consisted of 25 subjects who had at least 20 teeth in their mouths. Both groups were almost identical in terms of gender representation (48.0% and 52.0%) (table 1).

Table 1: Distribution of subjects according to gend

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

*EG – examined group; **CG – control group

The average age of the subjects in the examined group was 58.4±5.6 years, and in the control group it was 58.1±9.4 years (table 2).

The observed difference in age between the two groups is statistically not significant for $p > 0.05$ (table 3).

Table 2: An overview of the average age of the subjects in the control group and the examined group

Age	Number	Mean	Minimum	Maximum	St.Dev.
EG*	25	58.4	49.0	67.0	5.551877
CG**	25	58.1	35.0	69.0	9.360021

Table 3. Mann Whitney U Test for age

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

Table 4. Descriptive statistics for unstimulated saliva samples

Unstimulated saliva(ml/min)	n	Mean	Minimum	Maximum	St.Dev.
Before dentures placement – EG	25	0.35	0.2	0.6	0.100499
After dentures placement – EG	25	0.74	0.4	1.0	0.155134
1 month after dentures placement - EG	25	0.52	0.3	0.7	0.124766
Control group	25	0.56	0.3	0.8	0.122066

Table 5. ANOVA test for unstimulated saliva in the examined group

Examined group	SS	df	MS	SS	df	MS	F	P
Unstimulated saliva	1.893067	2	0.94653	1.19360	72	0.0165	57.096	0.000000

Table 6. Post-hoc Tukey HSD test for unstimulated saliva in the examined group

Examined group Unstimulated saliva	Before dentures placement	After dentures placement	1 month after dentures placement
Before dentures placement		0.000111	0.000155
After dentures placement	0.000111		0.000111
1 month after dentures placement	0.000155	0.000111	

Table 7. Mann Whitney U test for unstimulated saliva between the examined group and the control group

Unstimulated saliva	Rank Sum	Rank Sum	U	Z	p-level
Before dentures and CG*	881.0000	394.0000	69.00000	4.724594	0.000002
After dentures and CG*	435.5000	839.5000	110.5000	-3.91938	0.000089
1 month after dentures and CG*	675.0000	600.0000	275.0000	0.727607	0.466855

Both groups were homogeneous in terms of gender and age.

The average value of the amount of unstimulated saliva in the examined group before dentures placement was 0.35±0.1 (ml/min), after dentures placement it was 0.74±0.2 (ml/min), while 1 month after dentures placement it was 0.52±0.1 (ml/min), while in the control group it was 0.56±0.1 (ml/min) (table 4).

The observed difference in the average amounts of unstimulated saliva in the examined group before prosthetic rehabilitation, immediately after dentures placement and one month after dentures placement is statistically significant for $p<0.000000$ (table 5).

Post hoc Tukey HSD test is significant between the amount of unstimulated saliva before the prosthodontic rehabilitation and the amount of unstimulated saliva immediately after the prosthodontic rehabilitation. The difference is significant between the amount of unstimulated saliva before the prosthodontic rehabilitation and the amount of unstimulated saliva 1 month after the prosthodontic rehabilitation. According to the Post hoc Tukey HSD test, the difference between the amount of unstimulated saliva immediately after placing the dentures and the amount of unstimulated saliva after 1 month of wearing of the dentures is significant for $p<0.05$ (table 6).

The observed difference between the average amounts of unstimulated saliva in the studied group before placing the prostheses and the control group is statistically significant for $p<0.000002$. The observed difference between the average amounts of unstimulated saliva in the studied group after placing the prostheses and the control group is statistically significant for $p<0.000089$. The observed difference between the average amounts of unstimulated saliva in the studied group one month after placing the prostheses and the control group is statistically insignificant for $p>0.05$ (table 7).

The average value of the amount of stimulated saliva in the examined group before dentures placement is 0.7±0.1 (ml/min), after dentures placement it is 1.1±0.2 (ml/min), 1 month after dentures placement it is 0.9±0.1 (ml/min), while in the control group it is 0.9±0.1 (ml/min) (table 8).

Table 8. Descriptive statistics for the stimulated saliva samples

Stimulated saliva (ml/min)	n	Mean	Minimum	Maximum	St.Dev.
Before dentures placement – EG	25	0.7	0.5	1.0	0.115036
After dentures placement – EG	25	1.1	0.7	1.3	0.160000
1 month after dentures placement - EG	25	0.9	0.8	1.2	0.118040
Control group	25	0.9	0.7	1.3	0.135401

Table 9. ANOVA test for unstimulated saliva in the examined group

Examined group	SS	df	MS	SS	df	MS	F	P
Stimulated saliva	1.392800	2	0.696400	1.266400	72	0.01758	39.59318	0.000000

Table 10. Post-hoc Tukey HSD test for the stimulated saliva in the examined group

Examined group Unstimulated saliva	Before dentures placement	After dentures placement	1 month after dentures placement
Before dentures placement		0.000111	0.000114
After dentures placement	0.000111		0.001629
1 month after dentures placement	0.000114	0.001629	

Table 11. Mann Whitney U test for stimulated saliva between the examined group and the control group

Stimulated saliva	Rank Sum	Rank Sum	U	Z	p-level
Before dentures and CG*	873.0000	402.0000	77.00000	4.569371	0.000005
After dentures and CG*	493.5000	781.5000	168.5000	-2.79401	0.005206
1 month after dentures and CG*	654.0000	621.0000	296.0000	0.320147	0.748857

The observed difference between the average amounts of stimulated saliva in the examined group before dentures placement, immediately after dentures placement and one month after dentures placement is statistically significant for p<0.000000 (table 9).

Post hoc Tukey HSD test is significant between the amount of stimulated saliva before dentures placement, versus the amount of stimulated saliva immediately after dentures placement. The difference is significant between the amount of stimulated saliva before dentures placement, versus the amount of stimulated saliva 1 month after dentures placement. According to the Post hoc Tukey HSD test, the difference between the amount of stimulated saliva immediately after dentures placement and the amount of stimulated saliva after 1 month of wearing of the dentures is significant for p<0.05 (table 10).

The observed difference between the average amounts of stimulated saliva in the examined group before placing the dentures and the control group is statistically significant for p<0.000005. The observed difference between the average amounts of stimulated saliva in the examined group after placing the dentures and

the control group is statistically significant for p<0.005206. The observed difference between the average amounts of stimulated saliva in the examined group one month after placing the dentures and the control group is statistically insignificant for p>0.05 (table 11).

Discussion

If we take into account that complete dentures are made for patients at an advanced age, a period of life when it is difficult to accept new things, we can easily understand the expected problems that the dentist may encounter when making and placing the complete dentures. The problem becomes even more complicated if the patients have a systemic disease and/or receive a certain therapy, which negatively affects the secretion of saliva. Namely, xerostomia is present in a large number of adult patients, which makes it difficult to accept dentures. Beside the psychological characteristics of the patient and the adequacy of the fabrication, the presence of a sufficient amount of saliva, of adequate quality, is a very significant factor for accepting complete dentures.

The average value of the amount of unstimulated saliva in the examined group before placing of the dentures was 0.35±0.1(ml/min), immediately after placing the dentures was 0.74±0.2(ml/min), while 1 month after wearing the denture was 0.52±0.1(ml/min). In subjects from the control group, the amount of unstimulated saliva was 0.56±0.1 (ml/min) (table 4).

The observed difference between the average amounts of unstimulated saliva in the examined group before prosthodontic rehabilitation, immediately after placement, and one month after dentures placement is statistically significant for p<0.000000 (table 5).

According to the Post hoc Tukey HSD test, a statistically significant difference p<0.05 was also observed (table 6) between the amount of unstimulated saliva in all three periods of determining the amount of unstimulated saliva.

Compared to the control group, we observed a significant difference in the amount of unstimulated saliva in the examined group before dentures placement (where the secretion is reduced) and one month after wearing the dentures (where the secretion is increased) (table 7).

The mean values of the amount of stimulated saliva were understandably greater compared to the amount of unstimulated saliva. In the examined group, those values were as follows: 0.7±0.1(ml/min) before dentures placement, 1.1±0.2(ml/min) immediately after dentures placement, and 0.9±0.1(ml/min) 1 month after wearing the dentures. In subjects from the control group, the amount of stimulated saliva was 0.9±0.1 (ml/min) (table 8).

The differences in the amount of stimulated saliva (between the three test periods in the examined group, as well as between the control group and the examined group) were identical, as well as the differences in the amount of unstimulated saliva (table 9, 10 and 11).

The obtained results about the changes that occur in the secretion of saliva after dentures placement are in accordance with the studies done by Maheshwari[23], Jansen[24], Gabay[25] and Streckfus et al.[26]. The authors in their research, observed an increase in the amount of saliva after the placement of the dentures. This was especially accurate regarding the amount of stimulated saliva.

In our edentulous subjects, we observed a significantly lower amount of saliva compared to the subjects from the control group. This is due to the absence of stimuli in edentulous patients, which would cause adequate salivation. What is characteristic is the significant increase in the secretion of saliva immediately after placing the dentures. During that period, the secretion of saliva was significantly higher compared to the secretion of saliva in patients from the control group. We believe that the significant increase in saliva secretion immediately after placing the dentures is due to the fact that patients perceive the complete dentures as a foreign body in the mouth during that period. After a certain period of adaptation, the salivary flow normalizes. This is indicated by the fact that there is no significant difference in the amount of unstimulated and stimulated saliva between the patients one month after wearing the dentures, and subjects from the control group. We believe that such changes in the secretion of saliva are positive for the patients' adaptation to the new situation in the mouth. Starting from the positive effects that salivary secretion possesses, the increased secretion of saliva has a positive effect not only on the adaptation to the dentures, but also on the prevention of the occurrence of candida infections and the preservation of the overall oral health[27-32].

Conclusions

Based on the data from literature and the results obtained in our research, we can conclude that complete dentures have a significant impact on the salivary flow in edentulous patients. Additionally, the amount of unstimulated and stimulated saliva increases significantly immediately after placing the dentures. After a certain period of adaptation, the salivary flow normalizes. There is no significant difference in the amount of unstimulated and stimulated secretion of saliva between the patients one month after wearing the dentures and the subjects from the control group.

Reference

11. National Research Council (US) Panel on a Research Agenda and New Data for an Aging World. Preparing for an Aging World: The Case for Cross-National Research. Washington (DC): National Academies Press (US); 2001. 6, The Health of Aging Populations. Available from: https://www.ncbi.nlm.nih.gov/books/NBK98373/

2. Soboleva U, Rogovska I. Edentulous Patient Satisfaction with Conventional Complete Dentures. Medicina (Kaunas). 2022 Feb 24;58(3):344. doi: 10.3390/medicina58030344. PMID: 35334520; PMCID: PMC8953744.

3. Österberg T, Dey DK, Sundh V, Carlsson GE, Jansson JO, Mellström D. Edentulism associated with obesity: a study of four national surveys of 16 416 Swedes aged 55–84 years. Acta Odontologica Scandinavica. 2010;68(6):360–367

4. Hung HC, Colditz G, Joshipura KJ. The association between tooth loss and the self-reported intake of selected CVD-related nutrients and foods among US women. Community Dentistry and Oral Epidemiology. 2005;33(3):167–173

5. Sierpinska T, Golebiewska M, Dlugosz JW, Kemona A, Laszewicz W. Connection between masticatory efficiency and pathomorphologic changes in gastric mucosa. Quintessence International. 2007;38(1):31–37

6. Medina-Solis CE, Perez-Nunez R, Maupome G, Casanova-Rosado JF. Edentulism among Mexican adults aged 35 years and older and associated factors. American Journal of Public Health. 2006;96(9):1578–1581

7. de Pablo P, Dietrich T, McAlindon TE. Association of periodontal disease and tooth loss with rheumatoid arthritis in the US population. Journal of Rheumatology. 2008;35(1):70–76

8. Fisher MA, Taylor GW, Shelton BJ, et al. Periodontal disease and other nontraditional risk factors for CKD. American Journal of Kidney Diseases. 2008;51(1):45–52

9. Adam RZ, Kimmie-Dhansay F. Prevalence of Denture-Related Stomatitis in Edentulous Patients at a Tertiary Dental Teaching Hospital. Front Oral Health. 2021 Dec 1;2:772679. doi: 10.3389/froh.2021.772679. PMID: 35048072; PMCID: PMC8757833.

10. Kandelman D, Petersen PE, Ueda H. Oral health, generalhealth, and quality of life in older people. Spec Care Dentist 2008;28(6):224-36.

11. Е. Јанкуловска.Тотална протеза (Претклиника). Стоматолош-ки факултет, Скопје 2005.

12. Гугувчески Љ. Дејановски К, Велевски Д. Клиника на тотално протезирање.Стоматолошки факултет, Скопје 2003.

13. Kršek H, Dulčić N. Functional Impressions in Complete Denture and Overdenture Treatment. Acta Stomatol Croat. 2015 Mar;49(1):45-53. doi: 10.15644/asc49/1/6. PMID: 27688385; PMCID: PMC4945346.

14. Chalapathi Kumar VH, Surapaneni H, Ravikiran V, Chandra BS, Balusu S, Reddy VN. Retention of denture bases fabricated by three different processing techniques - An in vivo study. J Int Soc Prev Community Dent. 2016 May-Jun;6(3):245-50. doi: 10.4103/2231-0762.183106. Epub 2016 May 30. PMID: 27382542; PMCID: PMC4916800.

15. Akaltan F, Batak B, Oguz EI, Orhan K. Comparative analysis of denture base adaptation performance between pour and other conventional fabrication techniques. J Prosthet Dent. 2020 Jan;123(1):183.e1-183.e5. doi: 10.1016/j.prosdent.2019.10.001. Epub 2019 Nov 23. PMID: 31767202.

16. Alghriari O, Jani G, Al-E'nizy J. The Effect Esthetic Factors in Complete Dentures Wearers Acceptances. Indian Journal of Forensic Medicine & Toxicology. 2021;14(4):10

17. Devaki VN, Manonmani P, Balu K, Aravind RJ. Clinical management of highly resorbed mandibular ridge without fibrous tissue. J Pharm Bioallied Sci. 2012 Aug;4(Suppl 2):S149-52. doi: 10.4103/0975-7406.100256. PMID: 23066238; PMCID: PMC3467882.

18. Shekhar A, Das S, Bhattacharyya J, Goel P, Majumdar S, Ghosh S. A comparative analysis of salivary factors and maxillary denture retention in different arch forms: An in vivo study. J Indian Prosthodont Soc. 2018 Jan-Mar;18(1):53-60. doi: 10.4103/jips.jips_110_17. PMID: 29430143; PMCID: PMC5799970.

19. Ramanna PK. Wettability of three denture base materials to human saliva, saliva substitute, and distilled water: A comparative in vitro study. J Indian Prosthodont Soc. 2018 Jul-Sep;18(3):248-256. doi: 10.4103/jips.jips_301_17. PMID: 30111914; PMCID: PMC6070849.

20. Beill N. Factors in the mechanism of full denture retention- a discussion of selected papers. Dent Practit1976; 18:9-19.

21. Sachdeva S, Noor R, Mallick R, Perwez E. Role of saliva in complete dentures: an overview. Annals of Dental Specialty 2014; 2(2):51-54.

22. Navazesh M: Methods for collecting saliva. Ann N Y Acad Sci 1993; 694:73-77.

23. Maheshwari A, PalekarU, Awinashe V. Salivary Flow Assessment in Denture Wearers. National Journal of Medical and Dental Research 2013;1(3) 48-51.

24. Jansen J, Brodin P, 0rstavik J. Parotid salivary flow rates in twopatients during immediate denture.J Oral Rehabil. 1991; 18: 155–162

25. Gabay E. Flow rate, sodium and potassium concentration in mixed saliva of complete denture wearers. J Oral Rehabil 1980;7:435-43.

26. Streckfus CF, Brown LJ, Ship JA, Brunelle J. Stimulated parotid gland flow rates in healthy, elderly dentulous and edentulous individuals. J Prosthet Dent. 1993 Dec;70(6):496-9. doi: 10.1016/0022-3913(93)90261-l. PMID: 8277436.

27. Boroumand M, Olianas A, Cabras T, Manconi B, Fanni D, Faa G, Desiderio C, Messana I, Castagnola M. Saliva, a bodily fluid with recognized and potential diagnostic applications. J Sep Sci. 2021 Oct;44(19):3677-3690. doi: 10.1002/jssc.202100384. Epub 2021 Aug 18. PMID: 34350708; PMCID: PMC9290823.

28. Buranarom N, Komin O, Matangkasombut O. Hyposalivation, oral health, and Candida colonization in independent dentate elders. PLoS One. 2020 Nov 25;15(11):e0242832. doi: 10.1371/journal.pone.0242832. PMID: 33237956; PMCID: PMC7688165.

29. Pedersen AML, Sørensen CE, Proctor GB, Carpenter GH, Ekström J. Salivary secretion in health and disease. J Oral Rehabil. 2018 Sep;45(9):730-746. doi: 10.1111/joor.12664. Epub 2018 Jun 25. PMID: 29878444.

30. Dawes C, Wong DTW. Role of Saliva and Salivary Diagnostics in the Advancement of Oral Health. J Dent Res. 2019 Feb;98(2):133-141. doi: 10.1177/0022034518816961. PMID: 30782091; PMCID: PMC6900436.

31. Mäkinen AI, Mäkitie A, Meurman JH. Candida prevalence in saliva before and after oral cancer treatment. Surgeon. 2021 Dec;19(6):e446-e451. doi: 10.1016/j.surge.2021.01.006. Epub 2021 Feb 17. PMID: 33608227.

32. Ивановски Ќ, Пешевска С, Дирјанска К, Ристоска С. Орална биохемија и Физиологија. Универзитет „Св. Кирил и Методиј" во Скопје, Стоматолошки факултет – Скопје: Скопје, 2022:83-85.