

# Diagnosis of oral hygiene status in people of different age groups and with different duration of removable dentures use with the help of a new computer program

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## Key words:

oral hygiene, dentures, age groups, software.

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**Objective of the work** was to determine the effectiveness of the proposed oral hygiene (OH) system for patients of different age groups and with different duration of removable dentures use with the help of a computer program for the oral hygiene index assessment.

**Materials and methods.** The article presents results of the developed index study – an integral index of oral hygiene (IIOH), using a computer program, in 227 patients with removable dentures, aged 35 to 75 years and over. Among them, 112 persons used the common oral hygiene treatment scheme (group I) and 115 – the new one, proposed by us (group II).

**Results.** In patients of different ages in the 2nd group, a significant decrease in the IIOH after the 1st and 2nd stages of hygienic measures was revealed compared with the initial data by 47.86 %, 42.86 %, 49.19 % and 41.78 %, 37.46 %, 34.85 %,  $P \leq 0.05$ , respectively. At all stages of the proposed hygiene system usage, in patients of group II, there was a significant decrease in IIOH in the range from 1.71 to 2.01 times compared with values of group I individuals. The greatest difference was in patients aged 75 years and over, indicating the need for special attention to oral hygiene for this population. In spite of the OH deterioration with an increase in duration of removable dentures usage, the value of IIOH was significantly lower in patients of group II in comparison to the data of group I both after the first and the second stages of hygienic measures and were within the range of 22.09–36.94 (group I: 32.99–64.82).

**Conclusions.** By using the computer program for IIOH assessment and the proposed oral hygiene system, the proper oral hygiene (IIOH “good”, “satisfactory”) as well as objective diagnosis of changes has been achieved in persons of the II group.

## Ключові слова:

гігієна ротової порожнини, знімні протези, вікові групи, комп'ютерна програма.

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## Діагностика стану гігієни ротової порожнини в осіб різних вікових груп і з різними термінами користування знімними протезами за допомогою нової комп'ютерної програми

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**Мета роботи** – встановити ефективність запропонованої системи гігієни ротової порожнини (ГРП) для пацієнтів різних вікових груп і з різними термінами користування знімними пластинковими протезами за допомогою комп'ютерної програми для визначення індексу гігієни.

**Матеріали та методи.** Наведені результати вивчення розробленого індексу – інтегрального показника гігієни ротової порожнини (ІПГРП) за допомогою комп'ютерної програми у 227 пацієнтів зі знімними пластинковими протезами віком від 35 до 75 та більше років. Загальноприйнятої схеми гігієнічного догляду за ротовою порожниною дотримувалися 112 осіб (I група), нової, запропонованої нами, – 115 (II група).

**Результати.** У пацієнтів II групи різного віку встановили вірогідне зниження ІПГРП після I та II етапів гігієнічних заходів порівняно з вихідними даними – на 47,86 %; 42,86 %; 49,19 % та 41,78 %; 37,46 %; 34,85 % відповідно,  $p \leq 0,05$ . На всіх етапах використання запропонованої системи гігієни в пацієнтів II групи спостерігали вірогідне зниження ІПГРП у діапазоні 1,71–2,01 раза порівняно зі значеннями в осіб I групи. Найбільша різниця була в пацієнтів віком 75 років і більше, що вказує на необхідність особливої уваги до гігієни ротової порожнини у цього контингенту. Незважаючи на погіршення стану ГРП зі збільшенням термінів користування знімними протезами, значення ІПГРП у пацієнтів II групи порівняно з даними хворих I групи були вірогідно меншими як після першого, так і після другого етапів гігієни в межах 22,09–36,94 (група I: 32,99–64,82).

**Висновки.** Завдяки використанню комп'ютерної програми для визначення ІПГРП і запропонованої системи гігієни ротової порожнини вдалося досягти належного рівня гігієни (ІПГРП «хороший», «задовільний») в осіб II групи та об'єктивно діагностувати ці зміни.

## Ключевые слова:

гигиена полости рта, съемные протезы, возрастные группы, компьютерная программа.

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## Диагностика состояния гигиены полости рта у лиц разных возрастных групп и с разными терминами пользования съемными протезами с помощью новой компьютерной программы

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**Цель работы** – установить эффективность предложенной системы гигиены полости рта (ГПР) для пациентов разных возрастных групп и с разными терминами пользования съемными пластинчатыми протезами с помощью компьютерной программы для определения индекса гигиены.

**Материалы и методы.** Приведены результаты изучения предложенного индекса – интегрального показателя гигиены полости рта (ИПГРП) с помощью компьютерной программы у 227 пациентов со съемными пластинчатыми протезами в

возрасте от 35 до 75 и больше лет. Общеизвестной схемы гигиенического ухода за полостью рта придерживались 112 пациентов (I группа), новой, предложенной нами, – 115 (II группа).

**Результаты.** У пациентов II группы разного возраста установили достоверное снижение ИПГПР после I та II этапов гигиенических мероприятий по сравнению с исходными данными – на 47,86 %; 42,86 %; 49,19 % и 41,78 %; 37,46 %; 34,85 % соответственно,  $p \leq 0,05$ . На всех этапах использования предложенной системы гигиены у пациентов II группы наблюдали достоверное снижение ИПГПР в диапазоне 1,71–2,01 раза по сравнению со значениями больных I группы. Наибольшая разница была у пациентов в возрасте 75 лет и больше, что указывает на необходимость особенного внимания к ГПР у данного контингента. Несмотря на ухудшение состояния ГПР с увеличением сроков пользования съемными протезами, значения ИПГПР у пациентов II группы по сравнению с данными больных I группы были достоверно меньшими как после первого, так и после второго этапов гигиены в пределах 22,09–36,94 (группа I: 32,99–64,82).

**Выводы.** Благодаря использованию компьютерной программы для определения ИПГПР и предложенной системы гигиены полости рта удалось достичь надлежащего уровня гигиены (ИПГПР «хороший», «удовлетворительный») у лиц II группы и объективно диагностировать эти изменения.

## Introduction

The use of computer programs in dentistry is an important trend, the effectiveness of which is indisputable both in the diagnosis of dental pathology and in the treatment plan preparation and its realization. Well known computer programs are used in X-ray diagnostics, orthodontic pathology analysis, immunology, periodontology, and orthopedic treatment [1–4]. However, their use in the diagnosis of oral hygiene in persons wearing removable dentures is not widespread, although the proportion of manufactured removable dentures among all other types of orthopedic constructions in the Ukrainian population was 25.0–24.6 % (2014–2015 years), and the average figures for persons wearing removable dentures ranged from 13.0 % to 29.3 % in Europe (2007) including 3–13 % of people wearing complete removable dentures in both jaws [5].

Also, there are no complex systems of professional-individual oral hygiene with a step-by-step algorithm for diagnosis and oral hygiene procedures for persons wearing partial and complete removable dentures.

We can see a non-medical approach to the problem, but rather the marketing one as if it is financially unprofitable for dentists and manufacturer of dental products, so dental progress is lacking in this regard in both developed and developing countries.

Taking into account all these factors, the objective of our work was to determine the effectiveness of the proposed system of OH for patients of different age groups and with different duration of removable dentures use with the help of a computer program for the oral hygiene index assessment.

## Aim

Objective of the work was to determine the effectiveness of the proposed oral hygiene system for patients of different age groups and with different duration of removable dentures use with the help of a computer program for the oral hygiene index assessment.

## Materials and methods

In the Clinic of the Department of Dentistry of Postgraduate Education, IFNMU, 227 patients participated in the study. We formed two groups: I – 112 patients with removable dentures (RD), who used a common scheme of hygienic oral care; II – 115 patients with RD, who used the new diag-

nostic, treatment and rehabilitation system of oral hygiene (OH). Before the use of various hygiene complexes, after the stages of professional hygiene (stage I) and personal hygiene (stage II), patients of both groups were performed a diagnosis of the OH state for the integral index of oral hygiene (IIOH), which was determined using a computer program. Medical diagnostic computer program “Integral index of oral hygiene in persons with removable dentures” is an expert analytics system executed in the programming language “JavaScript” [6]. It was based on the “Method of Integral Assessment of the Hygienic Condition of the Oral Cavity in Persons with Removable Dentures” (Patent of Ukraine for invention No. 101919, 2013) [7].

Clinical characteristics of studied groups are presented in *Table 1*.

In the previous studies, based on the use of  $\chi^2$ -criterion, it has been established that the age, presence of general somatic pathology and duration of RD wearing are factors influencing significantly the OH state, based on the IIOH rate in patients with RD. Representatives of the age groups under 65 and over 65, as well as persons wearing RD up to 0.5 year and over three years showed significantly different mean values of IIOH [8,9]. Therefore, in this article, we have focused on the analysis of the change in the OH, determined by the computer program in patients of the two groups, taking into account such factors as the age and duration of RD wearing.

Patients of the group II underwent the new diagnostic, treatment and rehabilitation system of oral hygiene, which included professional and individual measures [10]. In addition to well-known professional measures, cleaning and disinfection of RD were performed in an ultrasonic cleaner, using chemical agents, ozone therapy on the prosthetic tissue and tongue by author’s methods. The system included differentiated toothpaste assignments: with chlorhexidine or triclosan and propolis, such as the “Lacalut Active” by “Dr. Theiss Naturprodukt Vega” (Germany), “Colgate Total Propolis”, “Colgate-Palmolive Co.” (China), as well as toothpaste “President active” with triclosan, zinc citrate and herbs by “Betafarma” (Italy). Probiotics “Lactobacterin dry” (“Biopharma”, Ukraine), “BioGaiaORS” (“Bio Gaia AB”, Sweden) (powder in packages) were prescribed for general and local use.

Personal hygienic measures for daily use in persons with a proper condition of oral hygiene included the use of dentifrices – lactic acid, essential oils from mint, sage, chamomile extracts “Biokon” (“Biokon”, Ukraine) against gum disease, prescription of essential oils for mouthwash –

**Table 1.** Characteristics of studied groups

Total number in the groups, %	The average age in the groups			Duration of RD wearing		
	35–64	65–74	75 and >	to 0.5	0.5–3.0	>3
I (112)	51	27	34	25	65	21
II (115)	69	27	19	28	70	17

**Table 2.** Mean values of IIOH in patients of different age groups wearing RD in the process of OH complexes using

Groups	Characteristic		Age groups, years		
			35–64	65–74	75 and >
IIOH (c.u.)	before treatment	I	50.72 ± 2.73 <sup>*1</sup>	53.14 ± 4.27 <sup>*</sup>	51.52 ± 3.80 <sup>*2</sup>
		II	47.01 ± 2.31 <sup>1,2</sup>	46.85 ± 2.70 <sup>1,2</sup>	52.92 ± 4.90 <sup>1,2</sup>
	after the I stage	I	43.22 ± 2.35 <sup>*</sup>	47.06 ± 3.71 <sup>*</sup>	45.90 ± 3.42 <sup>*</sup>
		II	24.51 ± 0.87	26.77 ± 1.48	26.89 ± 1.85
	after the II stage	I	54.88 ± 2.72 <sup>*3</sup>	58.41 ± 4.40 <sup>*3</sup>	59.40 ± 3.99 <sup>*3</sup>
		II	27.37 ± 1.05 <sup>3</sup>	29.3 ± 1.46 <sup>3</sup>	34.48 ± 2.41 <sup>3</sup>

**Statistical significance (P ≤ 0.05):** 1 – between values before and after the stage I; 2 – between before and after the stage II; 3 – between the 1st and 2nd stages; \* – between the indicators of the 1st and 2nd groups; **IIOH:** integral indicator of oral hygiene; **RD:** removable dentures; **OH:** oral hygiene.

**Table 3.** Mean values of IIOH in patients with different duration of RD wearing in the process of OH complexes using

Groups	Characteristic		Duration of RD wearing		
			to 0.5	0.5–3	>3
IIOH (c.u.)	before treatment	I	39.03 ± 3.59 <sup>1,2</sup>	54.97 ± 2.59 <sup>*1,2</sup>	55.63 ± 3.91 <sup>1,2</sup>
		II	29.84 ± 3.37 <sup>1,2</sup>	48.5 ± 1.97 <sup>1,2</sup>	59.02 ± 5.30 <sup>1,2</sup>
	after the I stage	I	32.99 ± 2.85 <sup>*</sup>	47.7 ± 2.30 <sup>*</sup>	50.45 ± 3.33 <sup>*</sup>
		II	22.09 ± 1.19	25.60 ± 0.89	30.26 ± 1.68
	after the II stage	I	41.88 ± 3.77 <sup>*3</sup>	60.35 ± 2.55 <sup>*3</sup>	64.82 ± 3.86 <sup>*3</sup>
		II	24.55 ± 1.43 <sup>3</sup>	28.85 ± 0.98 <sup>3</sup>	36.94 ± 2.39 <sup>3</sup>

**Statistical significance (P ≤ 0.05):** 1 – between values before and after the stage I; 2 – between before and after the stage II; 3 – between the 1st and 2nd stages; \* – between the indicators of the 1st and 2nd groups; **IIOH:** integral indicator of oral hygiene; **RD:** removable dentures; **OH:** oral hygiene.

peppermint or orange peppermint (“Adverso”, Ukraine). The course of the OH measures depended on the values of IIOH, the presence of somatic pathology and the use of adhesives.

For persons with an inadequate condition of OH, personal hygienic measures included the use of a toothpaste with lactic acid and essential oils from cypress, peppermint, coniferous carotene extract “Biokon – triple protection”, “Forest Freshness”, “Biokon” (Ukraine); essential oils composition for mouthwash “For the oral hygiene” (“Adverso”, Ukraine).

Patients were performed micro-polishing of removable dentures regardless of the IIOH value immediately after a removable denture manufacture in an ultrasonic cleaner by the developed way for 10 minutes during the course of professional OH.

Group I patients were using a well-known guidelines for OH, in particular, the removal of soft and calcified deposits, antiseptic treatment of the oral cavity and RD, cleaning and polishing of RD, recommended therapeutic prophylactic toothpastes, rinses, and herbs decoctions. The hygienic measures regime – twice a year.

The verification of the results was carried out by the methods of variation statistics. The significance of difference between the average values of IIOH was determined by Student’s criterion for unrelated samples. Statistical significance was defined at a level of P ≤ 0.05 for all the results obtained.

## Results

We give the average values of IIOH in patients wearing RD of different age groups (35–64; 65–74; 75 and >) in the process of applying well-known hygienic measures and the ones, proposed by us (Table 2).

The average values of IIOH in patients with duration of RD wearing for six months, from six months to three years and more than three years in the process of different OH complexes using are given in Table 3.

## Discussion

Analyzing the dynamics of the oral hygiene index – IIOH, which was determined by computer program, in patients of the I group, aged 65–74 and 75 years or older, an insignificant decrease in the index was found after professional hygienic measures as compared to the initial data.

A significant 14.79 % (P ≤ 0.05) decrease in the value of IIOH was revealed in the same group of patients at the age of 35–64 years in comparison to its value before treatment. Among people over 75 years of the same group, a significant increase in the index after the complex of individual hygienic measures was found compared with those before treatment and after the stage I by 15.30 % and 10.91 % (P ≤ 0.05), respectively.

In the other two age groups of patients who used the well-known OH measures, a significant increase in the index (P ≤ 0.05) was evident after the second stage of measures, compared with the first, 11.66 c.u. and 11.35 c.u., respectively. Thus, we can state the low effectiveness of hygienic measures in the first group of patients, especially after the individual hygienic procedures that they were more likely to do on their own. Instead, patients of the II groups of different ages showed a significant decrease in IIOH after both the first stage of hygienic measures and after the second one, compared with the initial values by 47.86 %, 42.86 %, 49.19 % and 41.78 %, 37.46 %, 34.85 %, P ≤ 0.05, respectively. After the second stage of hygienic measures, a significant increase in the IIOH values in all age groups was noted, compared with the data after the stage I by 2.86 c.u., 2.53 c.u. and 7.59 c.u., P ≤ 0.05, however, all indicators were within the values of IIOH index “good” and “satisfactory”. The greatest difference was in the patients aged 75 years or older, indicating the need for special attention to the OH in this contingent. Compared with the data of IIOH in group I, there was a significant decrease in the index ranging from 1.71 to 2.01 times in patients of group II at all stages of treatment.

In patients of group I, different duration of RD wearing showed a significant decrease in the IIOH values after the first stage of treatment by 15.48 %, 13.23 % and 9.31 %, respectively, compared with the initial data. Although professional procedures had a certain level of efficiency, the index values were significantly lower than in patients of group II – 10.9 c.u. within six months of RD wearing; 22,1 c.u. – from 0.5 to 3.0 years and 20.19 c.u. – more than three years. After the second stage, in patients of group I, there was a significant increase in the values of IIOH, compared with the initial data and the data obtained after the professional hygiene, P ≤ 0.05. In contrast, in patients of group II, there was a significant decrease in the values of IIOH index in all RD wearing times, after both the first stage and after

the second one, in comparison with the initial data. In particular, more than 25.97 %, 47.22 %, 48.73 % after the first stage, and more than 25.98 %, 40.52 % and 37.41 % after the second stage, respectively. As with the analysis of different age groups, there was a significant increase in the indexes after the use of individual hygienic measures compared to the first stage, but they all corresponded to the value of IIOH "good" and "satisfactory".

In spite of the OH deterioration with an increase in duration of removable dentures usage, the value of IIOH was significantly lower in patients of group II in comparison to the data of group I both after the first and the second stages of hygienic procedures.

## Conclusions

1. The proposed computer program based on IIOH index allowed objective determination of oral hygiene status in patients of different age groups and with different duration of RD wearing before and after various hygienic complexes.

2. There was a significant improvement in OH among patients using our proposed measures compared to those using well-known ones after both the professional and individual hygienic measures.

**Prospects for further research.** The implementation of the proposed by us computer program in prosthodontic clinic would be an objective criterion for oral cavity status diagnosis at the stage of prosthodontic treatment with the help of RD and after the finishing. We expect that IIOH using will be useful for scientists in terms of problems learning related to removable prosthodontics.

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**Конфлікт інтересів:** відсутній.

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