

## СТОМАТОЛОГІЯ

UDC 616.314-76-044.342-037

*G.A. Kovalenko**Kharkiv national medical university***DECLINING QUALITY OF REMOVABLE DENTURES  
AT THE STAGES OF THE CLINICAL USING**

In the clinical stages of operation performed a comparative evaluation of the quality of laminar prostheses and proved that the partial and complete design of different technological quality indicator depending on the stage of clinical use. Substantiated prediction algorithms reduce the quality of orthopedic structures, the use of which allows you to determine with respect to tactics clinical monitoring of patients.

**Key words:** *dentistry, design of dental prostheses, quality, monitoring.*

Issues, which are associated with the need to study the role of dental materials to ensure the quality of orthopedic treatment, are not investigated systematically. Only some research and a few results of innovation this issue were published [1–4]. However, practical dentistry requires study of the causes of declining quality and development of algorithm for its evaluation for clinical application of removable dentures.

The purpose of the study was to explore the causes of declining quality and to develop algorithms for prediction quality of removable dentures at the stages of their clinical using.

**Objects and methods.** Clinical-population analysis of immediate, long-term results and clinical-technological evaluation of complication in the treatment with removable dentures are made by surveying a representative population of patients of the dental clinics of Kharkiv and Kharkiv region. The formation of a representative volume of sample was based on the rationale of the quantitative adequacy of the monitoring objects, depending on the variability of the individual indicators. Calculation of volume of sample (minimum number of objects of study) are made by a special formula [5, 6] for define the size of the sample. It is in accordance with the basic theoretical principles of medical statistics [7] and ensures the quantitative and qualitative representativeness of conclusi-

ons. To accomplish this objective, we have developed a special card that contains the results of direct examination and formal expert evaluation of RD, analysis of medical cards of dental patients (form №043/o). This publication presents the results of studying the clinical and technological quality prosthetic dentures from materials of domestic production, it is carried out under the integrated program and included study of the following types of prostheses: 23538 laminar dentures (partial – 11340; complete – 12190).

The criteria for evaluation the quality of removable dentures in the early period (up to 24 months of clinical using) and long-term (more than 24 months of clinical using) the following indicators were selected: color change, crack basis, the violation of fixation, breakdown of denture, the change of the anatomical shape due to the abrasion. Form of informative provision of the study was the results of the expert evaluation which was made according to form 043/o in the 10 hospitals: total number of analyzed dentures – 32442; the total number of dentists – 75 people, dental technicians – 103 people.

On the stages of the clinical using of orthopedic constructions (in the early period and long-term) comparative evaluation of the quality of 15652 laminar dentures (partial dentu-

res – 7240; complete dentures – 8412 was down. Form of informative provision of the study were the results of the expert evaluation which was made according to form 043/o in the 10 hospitals. It allowed when we are doing research to consider the main regularities of the structure of removable denture, the patterns of influence doctors qualification and dental technicians on the frequency and nature of the indicators of quality dentures at stages of their clinical using. The absolute and relative indicators, in particular indicator frequencies for each of the signs of declining quality (in percentages of the total number of this type prosthetic design [(P±m) %] were calculated for each of the dentures according to certain indicators of the quality. The following indicators were used for comparative evaluation of the quality of removable denture: the index of clinical and technological quality (ITQ – the ratio between the total numbers of signs declining quality of orthopedic constructions to the total number of these constructions) and the level of exploitative quality construction was calculated for each of the types of dentures (EQC; the specific gravity of removable dentures which are appropriated for the exploitation at the time of the expert evaluation).

In our research we were used well-known and widely used clinical-statistical and clinical-informative methods: quantitative analysis, expert evaluation; clinical and statistical (variation statistics [8, 9], the probabilistic distribution of the signs with the assessment of the reliability of results. We applied the method

of informative analysis of factor complexes and elements ANOVA (analysis of variance) for quality characteristics of uneven complexes [10]. To assess the prognostic value of some factors and their complexes we justified to use the main indicators of clinical informative analysis [11] and the technique of prediction [9]. The principles of sequential detection with the use of predictive tables lie in the basis of this technique. The characteristics of quality evaluation in these tables are the most informative and the most important factors that were determined by us according to analysis of variance.

**Results and their discussion.** The study of frequency of causes for the declining quality of removable dentures, in particular, laminar (partial and complete) dentures are made at the stages of their clinical using.

Change the color of the laminar dentures, as a manifestation of their declining quality (tab. 1), in the early period of their clinical using was seen in (0.02±0.02)% of partial dentures and in (0.03±0.04)% of complete dentures (p>0.05). In the long-term, for partial and complete dentures, the frequency of the color change significantly (p<0.001) increased: respectively, (0.4±0.1) and (0.1±0.1)% (p<0.05). On average, for laminar dentures in the early period color change was characterized in (0.1+0.001)% cases, in the long term in (0.4+0.1)% constructions. Cracks of laminar denture in the early period of their clinical using were revealed with the frequency (1.1±0.2)% in partial and (1.7±0.5)% in complete laminar dentures (p<0.05). In the long term, for both complete and

Table 1. The terms and signs of declining quality of removable laminar dentures

| The terms and signs of declining quality of prostheses |     |                 | Removable constructs of dentures: |                               |                  |                 |
|--|-----|-----------------|-----------------------------------|-------------------------------|------------------|-----------------|
|  |     |                 | laminar                           |                               |                  | p               |
| All constructs   |     |                 | partial                           | complete                      | together         |                 |
| Color change   | EPU | Abs.<br>(P±m)%* | 4<br>0.02±0.02                    | 8<br>0.03±0.04                | 12<br>0.1±0.0    | t=0.2<br>p>0.05 |
|  | LTU | Abs.<br>(P±m)%* | 53<br>0.4±0.1 <sup>a</sup>        | 31<br>0.1±0.1 <sup>a</sup>    | 84<br>0.4±0.1    | t=2.1<br>p<0.05 |
| Crack basis  | EPU | Abs.<br>(P±m)%* | 90<br>1.1±0.2                     | 104<br>1.7±0.5                | 194<br>0.8±0.2   | t=1.1<br>p>0.05 |
|  | LTU | Abs.<br>(P±m)%* | 2050<br>19.5±1.5 <sup>a</sup>     | 2649<br>23.1±2.5 <sup>a</sup> | 4699<br>20.0±5.0 | t=1.2<br>p>0.05 |
| Violation of fixation                                  | EPU | Abs.<br>(P±m)%* | 46<br>0.7±0.2                     | 153<br>2.4±0.8                | 199<br>0.8±0.2   | t=2.0<br>p<0.05 |
|  | LTU | Abs.<br>(P±m)%* | 2095<br>23,4±3,5 <sup>a</sup>     | 4215<br>36,2±5,3 <sup>a</sup> | 6310<br>26,8±6,7 | t=2.0<br>p<0.05 |

Extensive table 1

| The terms and signs of declining quality of prostheses |     |                 | Removable constructs of dentures: |                              |                 |                  |
|--|-----|-----------------|-----------------------------------|------------------------------|-----------------|------------------|
|  |     |                 | laminar                           |                              |                 |                  |
|  |     |                 | partial                           | complete                     | together        | p                |
| All constructs   |     |                 | 11348                             | 12190                        | 23538           | t=0.2<br>p>0.05  |
| Breakdown of denture                                   | EPU | Abs.<br>(P±m)%* | 17<br>0.5±0.2                     | 4<br>0.1±0.1                 | 21<br>0.1±0.01  | t=1.78<br>p<0.05 |
|  | LTU | Abs.<br>(P±m)%* | 1577<br>12.6±1.5 <sup>a</sup>     | 235<br>4.3±2.0 <sup>a</sup>  | 1812<br>7.7±1.9 | t=3.3<br>p<0.01  |
| Change of the anatomical shape (abrasion)              | EPU | Abs.<br>(P±m)%* | 89<br>1.1±0.3                     | 141<br>1.6±0.3               | 230<br>1.0±0.2  | t=1.17<br>p>0.05 |
|  | LTU | Abs.<br>(P±m)%* | 1219<br>15.3±2.6 <sup>a</sup>     | 872<br>12.0±2.4 <sup>a</sup> | 2091<br>8.9±2.2 | t=0.93<br>p>0.05 |

Note. EPU – manifestations of the decline in the quality dentures in the early period of using (up to 24 months), LTU – manifestations of the decline in the quality of construction in the long-term (more than 24 months), (P±m) % frequency of signs of reducing the quality of the dentures, ITQ – index clinical and technological quality dentures, <sup>a</sup> p≤0.05 in comparison with EPU; QI – level of quality dentures.

partial laminar dentures, the frequency of cracks increased significantly (p<0.001) and was respectively (19.5±1.5) and (23.1±2.5)% of the dentures (p>0.05). On average, for laminar dentures in the early period, the presence of cracks was found in (0.8±0.2)% dentures, in the long term cracks were found in (20.0±5.0)% dentures (p<0.001). Violation of fixation of laminar dentures in the early period of their clinical using was revealed with frequency (0.7±0.2)% in partial and (2.4±0.5)% in complete laminar dentures (p<0.05). In the long term, for both complete and partial laminar dentures, the frequency of violation of fixation of the prosthesis significantly (p<0.001) increased and was respectively (23.4±3.5)% and (36.2±5.3)% of constructions (p>0.05). On average, for laminar dentures in the early period of violation was registered in (0.8±0.2)% of cases, whereas in the long term in (26.8±6.7)% structures.

The breakdown of laminar dentures in the early period of their clinical using was revealed with frequency in (0.5±0.2)% of complete dentures and in (0.1±0.1)% cases in partial laminar dentures (p<0.05).

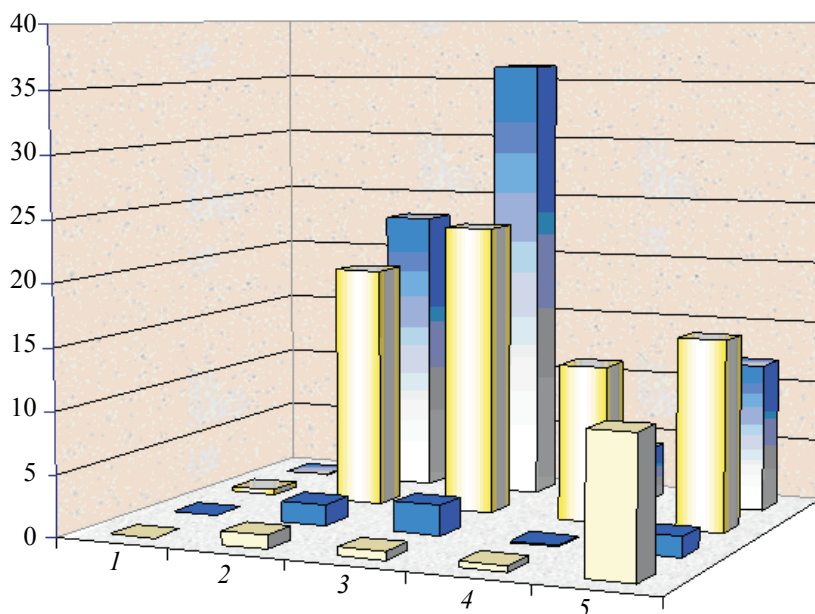
In the long term for complete dentures and partial laminar dentures, the frequency of breakdowns of constructions increased significantly (p<0.001) respectively was (12.6±1.5) and (4.3±2.0)% of cases and was significantly depended on type of construction (p<0.05). On average, for laminar dentures in the early period their breakages have taken place in (0.1±

0.001) % cases, whereas in the long term – in (8.9±2.2)% of dentures (p<0.05).

Violation of the anatomic shape of the laminar dentures due to abrasion in the early period of their clinical using was revealed with frequency (1.1±0.3)% in partial laminar dentures and (1.6±0.3)% in complete dentures (p>0.05). In the long term for partial and complete laminar dentures the frequency of violation of the anatomical shape increased significantly (p<0.001) (15.3±1.5)% and (12.0±2.4)% of cases respectively. It did not depend on the kind of design laminar denture (p>0.05). On average, in the early period the violation of the anatomical shape of laminar dentures took place in the (1.0±0.2)% of cases, whereas in the long term it was in (8.9±2.2)% of constructions (p>0.05).

So, the most common sign of the declining quality of laminar dentures at the stages of their clinical using is (represented in ranking order): violation fixing, crack basis, breakdown of the denture, the change of the anatomical shape and color of the constructs. For the practical application of indicators of the quality of the denture we investigated the predictive evidence of signs declining their quality depending on the duration of exploitation of the prosthesis (Figure, tab. 2). We found that the most informative indicators is a violation of fixation of the prosthesis (=2.116 bit), whereas other indicators are less informative.

The complex predictive evidence of quality laminar dentures can be performed on the basis of the special table prediction algorithm of



The frequency and nature of declining quality of orthopedic construction (partial and complete removable laminar dentures):  
 1 – color change; 2 – cracks bases; 3 – violation of fixation; 4 – breakdown of denture; 5 – change of shape

Table 2. Predictive value of signs declining the quality of laminar dentures depending on duration of their clinical using

| Rank factor | Indicators evaluation the quality of constructs |            | Terms of clinical using of removable dentures |              |                                 |           | Predictive value | Informative criterion | Reliability indicator |
|-------------|---|------------|---|--------------|---------------------------------|-----------|------------------|-----------------------|-----------------------|
|             |   |            | early period (up to 24 months)                |              | long term (more than 24 months) |           |                  |                       |                       |
|             | indicators                                      | graduation | abs.  | P±m (%)      | abs.                            | P±m (%)   |                  |                       |                       |
| 1.          | Violation of fixation                           | Yes        | 199   | 0.8±0.2      | 6310                            | 26.8±0.9  | -14.9            | 1.945                 | p<0.0001              |
|             |   | No         | 23339   | 99.2±0.2     | 17228                           | 73.2±0.9  | +1.3             | 0.171                 |                       |
|             |   | Total      | 23538   | 100.0        | 23538                           | 100.0     | -                | 2.116                 |                       |
| 2.          | Cracks basis                                    | Yes        | 194   | 0.8±0.2      | 4699                            | 20.0±0.8  | -13.9            | 1.335                 | p<0.0001              |
|             |   | No         | 23344   | 99.2±0.2     | 18839                           | 80.0±0.8  | +1.0             | 0.100                 |                       |
|             |   | Total      | 23538   | 100.0        | 23538                           | 100.0     | -                | 1.435                 |                       |
| 3.          | Breakdown of the denture                        | Yes        | 21  | 0.1±0.1      | 1812                            | 7.7±0.5   | -19.6            | 0.744                 | p<0.0001              |
|             |   | No         | 23517   | 99.9±0.1     | 21726                           | 92.3±0.3  | +0.3             | 0.013                 |                       |
|             |   | Total      | 23538   | 100.0        | 23538                           | 100.0     | -                | 0.757                 |                       |
| 4.          | Change of anatomical shape                      | Yes        | 230   | 1.0±0.2      | 2091                            | 8.9±0.6   | -9.4             | 0.379                 | p<0.01                |
|             |   | No         | 23308   | 99.0±0.2     | 21447                           | 91.1±0.6  | +0.4             | 0.014                 |                       |
|             |   | Total      | 23538   | 100.0        | 23538                           | 100.0     | -                | 0.393                 |                       |
| 5.          | Color change                                    | Yes        | 12  | 0.005±0.001  | 84                              | 0.03±0.01 | -9.0             | 0.013                 | p>0.05                |
|             |   | No         | 23526   | 99.995±0.001 | 23454                           | 99.7±0.01 | 0.0              | 0.000                 |                       |
|             |   | Total      | 23538   | 100.0        | 23538                           | 99.7±0.01 | -                | 0.013                 |                       |

declining quality of laminar dentures with use of Quality Assessing Scale at the stages of clinical using (tab. 3).

**Conclusions**

1. The most common signs of the declining quality of laminar dentures at the stages of their clinical using is violation fixing, crack basis,

breakdown of the denture, the change of the anatomical shape and color of the constructs. There were proved that decline quality depending on duration of clinical using. We found that the most informative indicators is a violation of fixation of the prosthesis (=2,116 bit), whereas other indicators are less informative.

Table 3. The predictive algorithm of declining the quality of laminar dentures

| The indicators of the quality evaluation of laminar dentures depending on the duration of their clinical using |                            | Pathometric coefficients |       |
|--|----------------------------|--------------------------|-------|
|  |                            | criterion                | QI    |
| 1.   | Violation of fixation      | Yes                      | -14,9 |
|  |                            | No                       | +1,3  |
| 2.   | Cracks basis               | Yes                      | -13,9 |
|  |                            | No                       | +1,0  |
| 3.   | Breakdown of the denture   | Yes                      | -19,6 |
|  |                            | No                       | +0,3  |
| 4.   | Change of anatomical shape | Yes                      | -9,4  |
|  |                            | No                       | +0,4  |
| 5.   | Color change               | Yes                      | -9,0  |
|  |                            | No                       | +0,0  |

| Quality Assessing Scale of laminar dentures |                        |  |                        |
|---|------------------------|--|------------------------|
|   | $IC_{\min} \leq -17,0$ |  | $IC_{\max} \geq +24,0$ |
|   | Low quality            |  | High quality           |

2. At the stages of the clinical using of orthopedic constructions (in the early period and long-term) comparative evaluation of the quality of 15652 laminar dentures (partial dentures – 7240; complete dentures – 8412) was done. There were proved that partial and complete laminar dentures are different by index of technological quality and frequency of certain signs of decline quality depending on the stage of clinical using.

3. We justified the predictive algorithms for declining quality of removable dentures that can be used to select tactic of clinical monitoring of patients.

**Perspective of further research** in this area are associated with the justification of constructive and auxiliary dental materials and the study of the quality of life of patients on the stages of the clinical using of removable dentures.

## References

1. Янішен І.В. Порівняльна оцінка якості незнімних конструкцій зубних протезів на етапах їх клінічної експлуатації / І.В. Янішен // Вісник проблем біології та медицини. – 2014. – Вип. 4, Т. 1. – С. 399–403.
2. Янішен І.В. Фактори, що визначають якість ортопедичних конструкцій: аналіз взаємозв'язків / І.В. Янішен // Проблеми екологічної та медичної генетики і клінічної імунології: Зб. наук. праць, 2014. – Вип. 4 (124). – Київ–Луганськ, 2014. – С. 412–421.
3. Hyde T.P. A Randomised Controlled Trial of Complete Denture Impression Materials / T.P. Hyde, N.L. Craddock, J.C. Gray // J. Dentistry. – 2014. – № 42 (8). – P. 895–901.
4. Does the nature of the definitive impression material influence the outcome of (mandibular) complete dentures? / J.F. McCord, L.M. McNally, P.W. Smith, N.J. Grey // Eur. J. Prosthodontics and Restorative Dentistry. – 2005. – № 13. – P. 105–108.
5. Белобородов С.М. Планирование клинического исследования / С.М. Белобородов // Проблемы репродукции. – 2003. – Ч. I, № 2. – С. 6–10.
6. Лехан В.М. Епідеміологічні методи вивчення неінфекційних захворювань // В.М. Лехан, Ю.В. Вороненко, О.П. Максименко. – Донецьк: АРТ-ПРЕС, 2004. – 184 с.
7. Дубикайтис Т.А. Случайные и систематические ошибки в исследованиях / Т.А. Дубикайтис // Рос. семейный врач. – 2003. – № 2. – С. 32–37.
8. Лищук В.А. Информатизация в клинической медицине / В.А. Лищук // Клиническая информатика и телемедицина. – 2004. – № 1. – С. 7–13.
9. Соціальна медицина та організація охорони здоров'я / Заг. ред. В.Ф. Москаленка, Ю.В. Вороненко. – Тернопіль, 2002. – С. 50–75.
10. Ледошук Б.О. Проблеми систематичних і випадкових помилок під час планування та виконання наукових досліджень / Б.О. Ледошук, Н.К. Троцюк // Демографічна та медична статистика у ХХІ столітті: Матер. конф. – К., 2004. – С. 121–124.

11. Чубенко А.В. Применение современных статистических методов в клинических исследованиях / А.В. Чубенко, П.Н. Бабич, С.Н. Лапач / Український медичний часопис. – 2003. – № 4. – С. 139–143.

*Г.А. Коваленко*

#### **ЗНИЖЕННЯ ЯКОСТІ ЗНІМНИХ КОНСТРУКЦІЙ ЗУБНИХ ПРОТЕЗІВ НА ЕТАПАХ КЛІНІЧНОЇ ЕКСПЛУАТАЦІЇ**

На етапах клінічної експлуатації виконана порівняльна оцінка якості зубних протезів та доведено, що часткові та повні конструкції дещо відрізняються індексом технологічної якості та частотою окремих ознак її зниження залежно від етапу клінічної експлуатації. Обґрунтовані алгоритми прогнозування зниження якості досліджених ортопедичних конструкцій, застосування яких дозволяє визначитися стосовно тактики клінічного моніторингу за пацієнтами.

**Ключові слова:** зубні протези, якість, моніторинг.

*Г.А. Коваленко*

#### **СНИЖЕНИЕ КАЧЕСТВА СЪЕМНЫХ КОНСТРУКЦИЙ ЗУБНЫХ ПРОТЕЗОВ НА ЭТАПАХ КЛИНИЧЕСКОЙ ЭКСПЛУАТАЦИИ**

На этапах клинической эксплуатации выполнена сравнительная оценка качества пластиночных протезов и доказано, что частичные и полные конструкции отличаются показателем технологического качества в зависимости от этапа клинической эксплуатации. Обоснованы алгоритмы прогнозирования снижения качества ортопедических конструкций, применение которых позволяет определяться относительно тактики клинического мониторинга за пациентами.

**Ключевые слова:** зубные протезы, качество, мониторинг.

*Поступила 13.02.17*