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Duration of Clinical Stages of Implant-Supported Fixed Dentures Manufacture with Screw-Retained Solid Abutments

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Abstract.

The article indicates that implant-supported fixed restoration with screw-retained solid abutments is the way of prosthetic rehabilitation of patients with different dentition defects. One of the uncertain legal status reasons for this kind of orthopedic surgery is the lack of institutional regulations of time for their performing.

The objective of research was to establish time standards for an orthopedist for manufacturing of implant-supported fixed structures with screw-retained solid abutments.

Materials and methods of the research

The object of research was a clinical process of dental orthopedic care in case of implant-supported fixed structures with screw-retained solid abutments manufacturing.

Scope of research involved the structure, sequence, duration and scope of the appropriate orthopedic care.

The standard time for the manufacturing of such structures by dentist-orthopedist is determined after appropriate time and motion research as the sum of duration of each prosthetic unit manufacturing in the structure of the prosthesis according to the nature of the working time spent on its production using the formula $ST = T_c + K \times T_{cc}$.

Results of the research

9 orthopedists made prosthetic appliances to 9 patients to whom 7 bridgeworks and 8 single crowns using screwed solid abutments were manufactured on 22 implants. Time and motion observations and the subsequent mathematical calculations of their work showed that the clinical process of implant-supported fixed dentures with screw-retained solid abutments manufacturing consists of 6 clinical stages during which constant time expenditure (T_c) of orthopedist constitute 165.73 minutes on any construction, and changeable-constant time expenditure (T_{cc}) comprises 31.24 minutes for a single crown and 47.47 minutes on bridgework with 2 foundations, therefore T_{cc} on 1 foundation in the prosthesis is 23.74 minute.

Thus, the time standard for the manufacture of a single crown $TS = T_c + K \times (T_{cc}) = 165.73$ min $+ 1 \times 31.24$ min $= 196.97$ min, where K is the number of single crowns. The time standard for the manufacture of a bridgework is $TS = T_c + K \times T_{cc}$ of 1 foundation $= 165.73$ min $+ 2 \times 23.74$ min $= 213.20$ min, where K is the number of bridge supports.

Conclusions. Time standard of orthopedist for implant-supported single crown with a screw-retained solid abutment manufacture for a particular patient is 196.97 min, and for the manufacture of bridge with two such foundations is 213.20 min.

When manufacturing such single crown or bridgework with a different number of structural elements for one patient several, the appropriate correction coefficient (K) corresponding either to a number of single crowns or to the number of bridge foundations is required to be used.

Problem statement and analysis of the latest research

According to the results of several scientific studies, the population of Ukraine is in a significant need for prosthetic dental care constituting 58.0-84.9% in different medical and geographical regions of the country [1,2].

One of the solutions to this problem is the use of dental implant procedures during the prosthetic rehabilitation of orthopedic patients. However, according to the analysis of the relevant orders of the Ministry of Health of Ukraine [3,4], despite fairly obvious effectiveness of dental implantation and subsequent prosthetic care, such medical and legal concept as a method of treatment with dental implants in our country does not have full legal status. This is partly due to the lack of departmental and time standards for conducting this kind of interventions. [5]

One of the varieties of superstructures for implant supported restoration is screw-retained solid abutments for fixing the fixed dentures by cementing. They are used both in case of single crowns and bridgeworks denture treatment. The impression is taken from the "level of abutment" using special impression copings. If necessary, the abutment may be adjusted in the mouth by diamond drill, but in this case the purpose of impression copings use is lost and the impression is taken directly from the abutment. [6]

It is necessary to admit that this kind of superstructure is not widely used in medical practice due to the fact that its use implies the need for implant placement with almost perfect parallelism, which is very difficult without the use of surgical guide [7].

If the abutments are installed parallel enough and (or) it is possible to use the corrected abutments in the mouth, it is quite possible to get a decent result when treating patients with implant-supported fixed restoration with screw-retained solid abutments at the current level of whole piece prosthesis productions.

The objective of research was to establish time standards for an orthopedist for manufacturing of implant-supported fixed structures with screw-retained solid abutments.

Materials and methods of the research

The object of the research involved clinical process of specialized dental implantological treatment by a specialst in the appropriate field in the manufacture of implant-supported fixed structures with screw-retained solid abutments.

The scope of research included the structure, sequence, duration and scope of the appropriate specialized dental implantological treatment.

Methods of the research:
- analytical approach – to determine the structure and nature of the labour input of an orthopedist in the manufacture of implant-supported fixed structures with screw-retained solid abutments;
- timing – to define the total duration of the respective clinical stages of implant-supported fixed structures with screw-retained solid abutments manufacturing;
- mathematical technique – to determine the value of departmental standards of time and conventional units of labour inputs for dentists to carry out the appropriate orthopedic prosthetic rehabilitation of patients with the use of dental implants;
- statistical approach – for mathematical processing of research results.

Results of the research

The technique of studying the chronometry by Labunets V.A. modification (1999) is used in determining the duration of the medical staff work in the dentistry [8]. This technique fully meets the requirements regarding to the work of experts in the field of dental implantology.

9 orthopedists made prosthetic appliances to 9 patients to whom 7 bridgeworks and 8 single crowns using screwed solid abutments were manufactured on 22 implants. Chronometric observations of their work were conducted during the research.

According to the methodological requirements, analytical method was used to determine the content and nature of the labour input of specialists at each clinical stage. Indexing of specialist's constant time expenditure (Tc) not depending on prosthetic construction and changeable-constant time

expenditure (Tcc) entirely depending on prosthetic construction and a number of prosthetic units in its structure was conducted.

After chronometric measuring the results were tabulated in the "Chart of chronometry measurements". Then Tc and Tcc indices were summed up. The result can be represented in the form of a table as the target time standard for certain types of orthopedic surgery:

TS = Tc + K x Tcc, where:

TS – time standard;

Tc - constant time expenditure;

Tcc – changeable-constant time expenditure;

K - the number of single crowns or bridgework supports necessary to be made for a single patient.

In the course of work, it was found that denture treatment both with a single crowns and implant-supported bridgeworks with screw-retained solid abutments is conducted in 6 clinical stages.

Summarized table (Table 1) presents the calculation of time standards for the manufacture of one single crown and bridge on 2 implants with screw-retained solid abutments by an orthopedist:

Table 1

Summary and duration of the clinical stages of implant-supported fixed structures with screw-retained solid abutments manufacturing by an orthopedist

№	The content of a stage	Time standard (min.)	
		Single crown	Bridge with the support on 2 implants
1.	Getting to know the patient and the provisional determination of the prosthetic construction.	27.48	27.48
2.	Making initial impression.	35.18	35.18
3.	Making the working impression and determination of central occlusion.	57.75	66.44
4.	Try-in of prosthetic construction framework.	22.93	24.58
5.	Try-in of prosthetic construction faced framework	24.04	27.02
6.	Fixing the prefabricated prosthetic construction	29.59	32.50
	Total:		
	Constant time expenditure	165.73	165.73
	Changeable-constant time expenditure	31.24	47.47
	The total time of prosthetic construction manufacture	196.97	213.20

Discussion of the results

According to the methodological requirements, in case of simultaneous manufacturing of multiple single crowns for a single patient time standard is determined by the formula:

TS = Tc + K x Tcc, where

K – the number of single crowns.

Example №1: The patient requires 1 single crown on the implant with screw-retained solid abutment.

Calculation:

TS one single crown = 165.73 min + 1cr x 31.24 min = 196.97 m.

Example №2: The patient requires 5 single crowns on 5 implants with the screw-retained solid abutment.

Calculation:

TS 5 single crowns = 165.73 min + 5cr x 31.24 min = 321.93 m.

If we do not use this methodological approach and simply multiply the time standard for a single crown manufacture by the number of crowns, we get unreal figures: 196.97 min x 5 crowns = 984.85 min.

Regarding the bridgework constructions on implants, the calculation should be conducted basing on the amount of the prosthesis supports on implant. In the calculations presented in the table, we judge from the fact that the prosthesis support is on two implants. Thus, alternately changeable-constant time expenditure (Tcc) entirely dependent on prosthetic construction, namely the number of support, should be divided by 2:

Tcc on one support = 47.47min / 2 support = 23.74 min.

Constant time expenditure (Tc) remains unchanged both in case of two supporting implants us and in case of different number of supports.

The time standard is determined according to the formula:

$$TS = Tc + K \times Tcc, \text{ where}$$

K - the number of supports in the bridgework

Example №3: The patient requires a bridge on 2 implants with screw-retained solid abutments. Calculation:

TS bridgework on 2 supports = 165.73 min + 2 x 23.74 min = 213.2 min.

Example №4: the patient requires bridgework on 3 implants with screw-retained solid abutments.

Calculation:

TS bridgework on 3 supports = 165.73 min + 3 x 23.74 min = 236.95 min.

Statistical processing of the results of chronometry measurements of clinical processes of prosthetic constructions manufacture on implant with screw-retained solid abutments it is necessary to determine the index of weighted arithmetic mean. There is no need in determining the average weighted arithmetic errors, because this process is not a sign of a linear relationship, and does not correspond to the postulates of the law of normal distribution of Gauss-Lyapunov [9].

Conclusions

Time standard of orthopedist for the manufacture of a single crown on the implant with a screw-retained solid abutment for a particular patient constitutes 196.97 min, and for the manufacture of bridgework with two such supports – 213.20 min.

The use of the appropriate correction coefficient (K) corresponding either to a number of single crowns or to the number of bridge supports is necessary in the process of manufacture of several single crowns or bridgeworks with a different number of structural elements for one patient.

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