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THE DETERMINATION OF INTRAORAL SCANNING DURATION IN THE ORAL CAVITY OF PATIENTS WITH ORTHODONTIC PATHOLOGY

Relevance. *Over the past decades, the level of spread of orthodontic pathologies has reached critical levels. It is well known that orthodontic care is not urgent and is provided mainly on a paid basis. Recently, digital technologies and protocols for providing medical care in the form of taking digital impressions of the jaws with scanners and computer programs for modeling indirect installation of braces, manufacturing orthodontic mouthguards, navigation templates, models, etc. have been widely introduced into the daily practice of Orthodontists.* **The purpose of this study.** *Improving the effectiveness of providing dental care to the population of Ukraine by determining the duration of intraoral jaw scanning and determining Central occlusion by orthodontists in a clinical appointment.* **Materials and methods of research.** *The first object of the study was dentists providing medical care in the specialty "orthodontics" of various qualifications, working in medical institutions of various forms of ownership in different regions of the country. The subject of the study was the nomenclature of modern types of orthodontic care in Ukraine. The second object of the study was the duration of dental orthodontic care in Ukraine. Time-based observations of the work of 12 orthodontists (of various qualifications and work experience) on scanning dentition rows in 12 patients with orthodontic pathologies in a clinical reception setting were carried out. The results of the timekeeping were entered in the "orthodontist's Working Time Chronocart".* **Research results and their discussion.** *Analysis of the results of timekeeping observations on these processes showed that the duration of providing these types of care directly depends on the relevant factors, namely: psychological preparation of the patient before the procedure, his behavior during its implementation, technical parameters of the intraoral scanner, professional experience and qualification of a specialist working with this particular scanner, technical characteristics of a computer program, the ability to process and interpret the results of scanning, a fairly long time is necessary to work in electronic patient accounting databases.* **Conclusion.** *The analysis of observations of the work of 12 orthodontists using an intraoral scanner in their clinical practice proved that the duration of providing the corresponding types of orthodontic care varies between 30.06-39.4 minutes (on average) and directly depends on a number of objective and subjective factors. Conventional units of labor intensity, respectively, are in the range of 0.5-0.66 CULI.*

Key words: *maxillofacial anomalies, complications of children and adults caries, periodontal diseases complications, digital protocol, scanning, timing.*

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ВИЗНАЧЕННЯ ТРИВАЛОСТІ ІНТРАОРАЛЬНОГО СКАНУВАННЯ ПОРОЖНИНИ РОТА У ПАЦІЄНТІВ З ОРТОДОНТИЧНОЮ ПАТОЛОГІЄЮ

Актуальність *За останні десятиріччя рівень розповсюдження ортодонтичних патологій досяг критичних показників. Загальновідомо, що ортодонтична допомога не є ургентною і надається, в основному, на платній основі. За останній час в повсякденну практику лікарів-ортодонтів достатньо широко впроваджуються цифрові технології і протоколи надання медичної допомоги у вигляді зняття цифрових відбитків щелеп сканерами та комп'ютерних програм моделювання непрямого встановлення брекетів, виготовлення ортодонтичних кап, навігаційних шаблонів, моделей та інше.* **Метою даного дослідження.** *Підвищення ефективності надання стоматологічної допомоги населенню України шляхом визначення тривалості інтраорального сканування щелеп і визначення центральної оклюзії лікарями-ортодонтами в умовах клінічного прийому.* **Матеріали і методи дослідження.** *Першим об'єктом дослідження були лікарі-стоматологи, що надають медичну допомогу за спеціальністю «ортодонтія» різної кваліфікації, що працюють в лікувальних закладах різної форми власності в різних регіонах країни. Предметом дослідження стала номенклатура сучасних видів ортодонтичної допомоги в Україні. Другим об'єктом дослідження стала тривалість надання стоматологічної ортодонтичної допомоги в Україні. Були проведені хронометражні спостереження роботи 12 лікарів-ортодонтів (різної кваліфікації та досвіду роботи) по сканування зубних рядів у 12 пацієнтів з ортодонтичними патологіями в умовах клінічного прийому. Результати хронометражу були занесені в «Хронокарту робочого часу лікаря-ортодонта».* **Результати дослідження та їх обговорення.** *Аналіз результатів хронометражні спостереження за даними процесами показав, що тривалість надання даних видів допомоги*

напряму залежить від відповідних факторів, а саме: психологічна підготовка пацієнта перед проведенням процедури, його поведінка під час її проведення, технічні параметри інтраорального сканеру, професійний досвід та кваліфікація фахівця, що працює з даним конкретним сканером, технічні характеристики комп'ютерної програми, спроможність обробляти і інтерпретувати отримані результати сканування, достатньо тривалий час необхідний для роботи в електроних базах обліку пацієнтів. **Висновок.** *Аналіз спостережень за роботою 12 лікарів-ортодонтів, що використовують у своїй клінічній практиці інтраоральний сканер, довів, що тривалість надання відповідних видів ортодонтичної допомоги коливається у межах 30,06-39,4 хвилини (в середньому) і напряму залежить від ряду об'єктивних і суб'єктивних факторів. Умовні одиниці трудомісткості, відповідно, знаходяться у межах 0,5-0,66 УОТ.*

Ключьові слова: *зубощелепні аномалії, ускладнення карієсу у дітей та дорослих, ускладнення захворювань пародонту, цифровий протокол, сканування, хронометраж.*

Relevance. Over the pasted decades, the spread level of orthodontic pathologies has reached critical indicators. Thus, according to the data of local scientists [1-4], in our country they varies between 24.43-83.33 % in children and 64.3-93.7 % in adolescents and adults as complications of caries and periodontal tissues diseases [5, 6].

Notoriously, that orthodontic care is not urgent and providing mainly on a paid basis. Based on this, in order to establish objective prices for patients and fair calculation of doctors salaries, nurses and dental technicians, as well as accounting for their work, a normative indicators of the duration of this or that technological stage of providing appropriate medical care are necessarily needed [7].

Recently, digital technologies and protocols for the provision of medical care in the form of taking jaw digital impressions with scanners and computer simulation programs for indirect installation of brackets, production of orthodontic caps, navigation templates, models, etc. have been widely introduced into the everyday practice of orthodontists [8].

The algorithm for using such devices involves the direct participation of the orthodontist at all diagnostic, clinical and technical stages of their use [9], which must be reflected in the time standards for orthodontic care.

At the modern stage of providing dental care, together with traditional methods of taking jaw impressions and determining the central occlusion, digital algorithms for fixing the jaw topography and their relative location in the oral cavity have appeared. This could be done with the help of both intraoral and laboratory dental scanners, digital computer models of the jaws.

The modern method of obtaining digital 3D jaw models is the oral cavity scanning with an intraoral scanner with the acquisition of computer files and subsequent production of jaw models by printing on a 3D printer (if necessary).

This method allows an orthodontist to do everything independently, without the involvement of third parties, at a time convenient for him, to send files for consultations to other specialists and to the dental laboratory for manufacturing products – for a large material resources and time extent save [10, 11].

The disadvantages are the necessity to have expensive equipment and undergo additional training.

Digital occlusion is a mandatory element of dental orthodontic care. It can be determined simultaneously with the removal of jaws digital impressions, and to be an independent type of orthodontic manipulation.

Digital occlusion is necessary for the optimal interposition of jaws digital models in the virtual space in order to accurately manufacture the necessary orthodontic products, to control and compare the initial and final results of orthodontic treatment [12-14].

Research materials and methods. The purpose of this study is to increase the efficiency of providing dental care to the population of Ukraine by determining the duration of jaws intraoral scanning and determining the central occlusion by orthodontists in the clinical appointment conditions.

The first object of the study were dentists providing medical care in the specialty "orthodontics" of various qualifications, working in medical institutions of different ownership in different regions of the country. The subject of the study was the nomenclature of modern types of orthodontic care in Ukraine.

The second object of the study was the duration of provision the dental orthodontic care in Ukraine, and the subject of the study was methodological measures and techniques for determining the duration of jaws intraoral scanning and determining the central occlusion by orthodontists in the clinical appointment conditions and defined standards of time and conventional units of labor intensity of providing the appropriate assistance.

Research methods:

– analytical – to determine the structure and nature of the orthodontist's labor costs while scanning the oral cavity with an intraoral scanner and determining the central occlusion;

– timing – to determine the total duration of the relevant clinical stages of the oral cavity scanning by an orthodontist with an intraoral scanner and central occlusion determination;

– mathematical – to determine the departmental standards value of the orthodontist's working time while scanning the oral cavity with an intraoral scanner and the central occlusion determination;

– statistical – for processing research results.

To determine the duration of the relevant clinical stages of scanning the oral cavity by an orthodontist with an intraoral scanner and to determine the central occlusion and establish the CUL, was used the method of determining labor costs in dentistry as modified by V. A. Labunets (1999) [15], which was officially approved by the Ministry of Health of Ukraine.

Because of the dentists work process character at the clinical stages of providing specialized care is a clear and consistent performance of certain manipulations consisting of a number of repeated and constant elements of the main operation, the time costs are previously indexed to permanent time costs (Tp), which are not depend on the number of structural elements or specialized actions (example: consulting a patient, taking an impression) and variable-repetitive time costs (Tvr), which completely depend on these factors (installation of a certain number of brackets, adjustment of screws, for example).

The method of indexing time costs by character and content is as follows: the expert observe the production process first divides into separate technological stages that have logical completion, and then evaluates the content of the work at this stage and determines how these manipulations are correlated with the nature of labor costs.

If these costs are affected by the number of elements or the design of the device, then the expert classifies them as variable-repetitive (Tvr), and if the nature of the labor costs does not change depending on the design and number of elements, then the time costs will be classified as permanent (Tp).

Based on the obtained data, according to methodological requirements, the summation of Tp and Tvr indicators is carried out, the result of which can be presented as the desired standard of time for certain types of orthodontic care:

TS = Tp + Tvr, where:

TS – time standard;

Tp – permanent time expenditure;

Tzp – variable-repetitive time expenditure.

Statistical processing of timing results consists in determining the weighted arithmetic average, without determining the error of this indicator [16].

Research results and their discussion. The process of the oral cavity scanning by an orthodontist with an intraoral scanner and determining the central occlusion consists of two stages each. The consultation stage is purely clinical, the second stage includes a number of technical elements on working with dental equipment.

Time-lapse observations of the work of 12 orthodontists (of various qualifications and work experience) were carried out on scanning the dental rows of 12 patients with orthodontic pathologies in the conditions of a clinical appointment. The results of the timing were entered in the "Time chart of the orthodontist's working hours".

At the same time, dentists used intraoral scanners of various models and manufacturers. Eight doctors received appropriate training in the use of intraoral scanners at specialized educational institutions, four learned how to work with the scanner on their own.

Our observations of the work of relevant specialists demonstrated that during intraoral scanning of the oral cavity and defined central occlusion there are no variable and repetitive time costs and all time costs are indexed as constant.

The analysis of the results of the time-lapse observation of these processes showed that the duration of these types provision of care directly depends on the relevant factors, namely: the psychological preparation of the patient before the procedure, his behavior during the procedure, the intraoral scanner technical parameters, specialist's professional experience and qualification, which works with this specific scanner, computer program technical characteristics, the ability to process and interpret the received scan results, a sufficiently long time is required for work in electronic databases of patient records.

Thus, the time standards for these types of orthodontic care are as follows:

Consultation stage (as an independent type of assistance) – 30.06 minutes;

Intraoral scanning of the oral cavity for the purpose of making digital models of the jaws (as an independent form of assistance) – 39.4 min.;

Taking impressions of the jaws using an intraoral scanner for the purpose of consulting the patient and further treatment planning (as an independent form of care) – 34.75 min.;

Determination of occlusion by scanning with an intraoral scanner (as an independent form of assistance) – 33.19 min.

Based on the methodological provisions of the official methods of determining labor costs in dentistry, where the volume of medical care provided during 60 minutes of working time is used to calculate the CUL (conditional labor intensive units) of a dentist's work at a clinical appointment, the CUL

indicators are calculated according to the following formula:

$$CUL = TS \div 1CUL,$$

where:

CUL – conventional units of labor intensity (in absolute numbers);

TS – time standard (in minutes);

1CUL is a conventional indicator of one conventional unit of labor intensity (in minutes).

According to the time standards that we've received for these types of orthodontic care, the time standards are as follows:

Consultation stage (as an independent type of assistance) – 0.5 CUL;

Intraoral scanning of the oral cavity for the purpose of making digital models of the jaws (as an independent form of assistance) – 0.66 CUL;

Taking impressions of the jaws using an intraoral scanner for the purpose of consulting the patient and further treatment planning (as an independent type of care) – 0.58 CUL;

Determination of occlusion by scanning with an intraoral scanner (as an independent form of assistance) – 0.55 CUL.

Conclusion. The analysis of observations of the work of 12 orthodontists using an intraoral scanner in their clinical practice proved that the duration of providing the relevant types of orthodontic care ranges from 30.06 to 39.4 minutes (on average) and directly depends on a number of objective and subjective factors. Conventional units of labor intensity, respectively, ranges between 0.5-0.66 CUL.

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