

ОРТОДОНТІЯ

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THE DURATION OF THE PROCESSES OF VIRTUAL BRACES PLACEMENT BY AN ORTHODONTIST ON THE JAWS DIGITAL MODELS AND MODELING AND CORRECTION OF TEMPLATES FOR THEIR TRANSFER TO THE ORAL CAVITY

The purpose of this study. Improving the effectiveness of providing dental care to the population of Ukraine by determining the duration of digital protocols of virtual placement of braces by an orthodontist on digital models of the jaws and computer modeling or correcting patterns for transferring braces from models to the oral cavity.

Research materials and methods. 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, and the subject of the study is methodological measures and techniques for determining the duration of digital protocols of virtual placement of braces by an orthodontist on digital models of the jaws and computer modeling or correcting patterns for transferring braces from models to the oral cavity and determining the time standards and conventional units of labor intensity of providing appropriate care. **Research results and their discussion.** Conducting time-based observations of the work of 8 orthodontists who performed 16 digital protocols of virtual placement of braces on digital models of the jaws and modeling or correcting patterns for their transfer to the oral cavity showed that they are quite complex and require mandatory preliminary training, and the duration of the process directly depends on the quality of the obtained digital models of the jaws, the ability of a specialist to work in a computer program, the features of interocclusal relations, oral health, the state of hard tissues of the teeth, this directly affects the place and quality of fixing braces on the teeth. The normative duration of these processes takes 76.63 minutes or 1.3 CUL for the process of virtual placement of braces

by an orthodontist on digital models of the jaws and 56.37 minutes or 1.0 CUL for computer placement or adjustment of templates for transferring braces from the model to the oral cavity. The consultation stage respectively lasts 30.06 minutes or 0.5 CUL.

Key words: maxillofacial anomalies, digital protocols, braces, oral health, teeth hard tissues, templates, timing.

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ТРИВАЛІСТЬ ПРОЦЕСІВ ВІРТУАЛЬНОГО РОЗТАШУВАННЯ ЛІКАРЕМ-ОРТОДОНТОМ БРЕКЕТІВ НА ЦИФРОВИХ МОДЕЛЯХ ЩЕЛЕП ТА МОДЕЛЮВАННЯ І КОРЕГУВАННЯ ШАБЛОНІВ ДЛЯ ЇХ ПЕРЕНОСУ В ПОРОЖНИНУ РОТА

Мета даного дослідження. Підвищення ефективності надання стоматологічної допомоги населенню України шляхом визначення тривалості цифрових протоколів віртуального розташування лікарем-ортодонтом брекетів на цифрових моделях щелеп та комп'ютерного моделювання або корегування шаблонів для переносу брекетів з моделей в порожнину рота **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, а предметом дослідження – методичні заходи і прийоми визначення тривалості цифрових протоколів віртуального розташування лікарем-ортодонтом брекетів на цифрових моделях щелеп та комп'ютерного моделювання або корегування шаблонів для переносу брекетів з моделей в порожнину рота і визначення нормативів часу і умовних одиниць трудомісткості надання відповідної допомоги. **Результати дослідження та їх обговорення** Проведення хронометражних спостережень роботи 8 лікарів-ортодонтів, які виконали 16 цифрових протоколів віртуального розташування брекетів на цифрових моделях щелеп та

моделювання або корегування шаблонів для їх переносу в порожнину рота показало, що вони достатньо складні і потребують обов'язкового попереднього навчання, а тривалість процесу напряму залежить від якості отриманих цифрових моделей щелеп, вміння фахівця працювати в комп'ютерній програмі, особливостей міжключієвих відносин, здоров'я порожнини рота, стану твердих тканин зубів, що напряму впливає на місце і якість фіксації брекетів на зубах. Нормативна тривалість даних процесів складає 76,63 хвилини або 1,3 УОТ на процес віртуального розташування лікарем-ортодонтом брекетів на цифрових моделях щелеп та 56,37 хвилини або 1,0 УОТ на комп'ютерне розташування або корегування шаблонів для переносу брекетів з моделі в порожнину рота. Консультаційний етап триває 30,06 хвилини або 0,5 УОТ відповідно.

Ключові слова: зубощелепні аномалії, цифрові протоколи, брекети, здоров'я порожнини рота, тверді тканини зубів, шаблони, хронометраж.

Relevance. In global trends, according to a number of local authors, up to 90% of children in the world suffer from caries, gingivitis and periodontal diseases, more than 80% of children have one or another dento-jaw anomaly, and the prevalence of periodontal diseases in children is the same in up to 70 % of cases with dento-maxillary anomalies. In case of children with vision problems, for example, the frequency of maxillofacial anomalies reaches 97.1 % [1-5]. Our abroad colleagues have similar indicators [6-11].

There are various types of orthodontic treatment to solve this kind of problem. For example, the bracket system is the main and most widespread method of modern orthodontic care, which began to be implemented in the everyday practice of orthodontists in the 60s and 70s last century decades.

It was built according to the principle of Engle's universal apparatus and has the following components: braces, locks, orthodontic arch, elastic ligatures. Braces are made of a variety materials, could be standard and individual, could have a common or similar design.

Lingual braces are a modern type of orthodontic care. They are distinguished from traditional braces by their very high cosmetic ability, because lingual braces are installed on the side of the palate or tongue. The peculiarity of working with this type of braces is that they are placed on digital models of the jaws using a computer program with mandatory consideration of occlusion, which the orthodontist can do on his own at a time convenient for him. In addition, with the help of the same computer program, it is possible to plan and place ordinary braces on digital models with the aim of their further transfer into the oral cavity using a template [12-16].

While planning an orthodontic treatment, including virtual treatment, requires a sufficiently large amount of intellectual, physical and material costs, which must be reflected in the form of a price for patients and a fair calculation of wages for orthodontists, which is fundamentally impossible without objective time standards for this type of medical care [17].

Research materials and methods. The purpose of this study is to improve the efficiency of providing dental care to the population of Ukraine by determining the duration of digital protocols for the virtual placement of braces by an orthodontist on the jaws digital models and computer modeling or adjustment of templates for transferring braces from the models to the oral cavity.

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 the provision of dental orthodontic care in Ukraine, and the subject of the study was methodical measures and techniques for determining the duration of digital protocols of virtual placement of braces by an orthodontist on digital models of the jaws and computer modeling or correction of templates for transferring braces from models to oral cavity and determination of time standards and conventional units of labor intensity of providing appropriate assistance.

Researching methods:

– analytical – to determine the structure and nature of the orthodontist's labor costs during the virtual positioning of braces by the orthodontist on digital models of the jaws and computer modeling or adjustment of templates for transferring the braces from the models to the oral cavity;

– timing – to determine the total duration of the process of virtual placement of braces by an orthodontist on digital models of the jaws and computer modeling or adjustment of templates for transferring braces from the models to the oral cavity;

– mathematical – to determine the amount of departmental standards of the orthodontist's working time during the virtual placement of braces by the orthodontist on the jaws digital models and computer modeling or adjustment of templates for transferring the braces from the models to the oral cavity;

– statistical – for processing research results.

To determine the duration of the orthodontist's work in a computer program for the virtual placement

of braces on digital models of the jaws and computer modeling or correction of templates for transferring braces from the models to the oral cavity and establishing standards of time and CUL, the method of establishing labor hours officially approved by the Ministry of Health of Ukraine was used costs in dentistry as modified by V.A. Labunets (1999) [16].

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;

Tvr – variable-repetitive time expenditure.

In this case, we can consider that the orthodontist, who places virtual braces on virtual digital models of the patient's jaws and simulates or corrects the template for transferring the braces from the model to the oral cavity, working in a computer program, mainly performs only labor costs indexed by time as permanent (Tp), because variable-repetitive costs (Tvr) are extremely insignificant and can be neglected.

Statistical processing of timing results consists in determining the average arithmetic weighted duration of each stage of the process, without determining the error of this indicator.

Research results and their discussion. Independent placement of conventional and lingual braces by an orthodontist on digital models of the jaws using computer programs is a rather complex process that requires mandatory prior specialized training, because based on the obtained results, templates are made in the conditions of a dental laboratory for transferring braces from models to the dental row in the oral cavity.

Time-lapse observations of the work of 8 orthodontists during the computer placement of conventional and lingual braces on digital models of the jaws showed that the duration of the process directly depends on the quality of the received jaws digital models, the ability of the specialist to work in the computer program and the peculiarities of the interocclusal relations in the oral cavity of a particular patient.

In addition, this specialist must be able to objectively assess the health of the oral cavity, namely the state of oral hygiene (with the help of hygiene indices) and the hard tissues of the tooth, which directly affects the location and quality fixation of braces on the teeth.

This element of orthodontic care consists a clinical consultation stage and a stage of independent work by the orthodontist from computer placement by the orthodontist of conventional and lingual braces on digital models of the jaws, as an independent stage of orthodontic care, the results of which are then used to model or adjust transfer templates braces from the models into the oral cavity, again as an independent stage of assistance.

In order for an orthodontist to carry out the process of computer placement of conventional and lingual braces on digital jaws models, as well as modeling or correcting templates for transferring braces from the models to the oral cavity, a preliminary scan of the patient's dentition with an intraoral scanner or scanning a plaster models of the jaws with a stationary scanner is required for the production of digital models of the jaws, which we consider as independent stages of orthodontic care.

While regarding the modeling or correction of templates for transferring braces from the models to the oral cavity, 5 linear time-tracking observations of the work of 5 dentists on this issue, and another 3 observations were performed personally by orthodontists according to the principles of self-timekeeping and recorded by them in the "Orthodontist's Working Time Chart". Total: 8 observations.

The analysis of the results of the chronometric observation of these processes showed that the time

of carrying out such processes depends on some conditions, namely: the health of the oral cavity, the condition of the hard tissues of the teeth, the quality of the previously performed scan, the quality of the produced digital models of the jaws, the quality of the Internet, the power of the computer, the complexity of the computer program and the specialist's ability to work in it, the quality of the patient's CT scan, the ability to process and interpret the obtained results, the possibility of communication with other specialists.

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

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

Computer placement of conventional and lingual braces on digital jaw models by an orthodontist (as an independent form of assistance) – 76.63 minutes;

Computer modeling or correction by an orthodontist of templates for transferring braces from models to the oral cavity (as an independent form of assistance) – 56.37 min.

Based on the methodological provisions of the official methodology for determining labor costs in dentistry, where the amount of medical care provided during 60 minutes of working time is used to calculate the CUL (conditional labor intensity units) of a dentist's work at a clinical appointment, the CUL indicators are calculated according to the following formula :

$$CUL = TS - 1CUL,$$

where:

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

TS – standard time (in minutes);

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

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

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

Computer placement by an orthodontist of conventional and lingual braces on digital models of the jaws (as an independent form of assistance) – 1.3 CUL;

Computer modeling or correction by an orthodontist of templates for transferring braces from the models to the oral cavity (as an independent form of assistance) – 1.0 CUL.

Conclusion. The time-lapse observations of the 8 orthodontists work showed that when they placed conventional and lingual braces on digital models of the jaws by computer (as an independent type of

care), the average time standard was 76.63 minutes, and the time standard for this type of orthodontic care was 1,3 CUL.

Regarding the work productivity of the same 8 orthodontists, but with computer modeling or their correction of templates for transferring braces from models to the oral cavity (as an independent type of assistance), the average time standards correspond to 56.37 minutes, and the time standards are 1,0 CUL.

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