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## FLOW OF TECHNICAL INFORMATION IN THE PRODUCTION PROCESS OF PROSTHETIC RESTORATIONS

### PRZEPIY W INFORMACJI TECHNICZNYCH W PROCESIE WYTWARZANIA UZUPELNIEN PROTETYCZNYCH

#### Abstract

In the implementation of specialized services a large attention is paid to the flow of information between cells which determine the proper execution of the task. In engineering services related to dentistry there appears to be a significant discrepancy connected with knowledge awareness. The article presents three areas of knowledge (in the range and possession of the required knowledge) and information flow between the patient, dentist and dental technician. A technical solution to increase the possibilities of obtaining information at the design stage of the restoration has also been proposed, by introducing a system of material selection and engineering techniques in dentistry.

*Keywords: information flow, dental restoration, dental engineering, material selection*

#### Streszczenie

W realizacji usług specjalistycznych dużą uwagę kładzie się na przepływ informacji pomiędzy poszczególnymi komórkami decydującymi o właściwej realizacji zadania. W usługach dotyczących inżynierii dentystycznej pojawia się znaczna rozbieżność w zakresie posiadanej wiedzy. W artykule zaprezentowano trzy obszary przechowywania wiedzy i przepływu informacji pomiędzy pacjentem, dentystą a technikiem dentystycznym. Zaproponowano również techniczne rozwiązanie zwiększenia możliwości pozyskania informacji na etapie projektowania uzupełnienia protetycznego przez wprowadzenie systemu doboru materiału i technik w inżynierii dentystycznej.

*Słowa kluczowe: przepływ informacji, uzupełnienie protetyczne, technika dentystyczna, dobór materiałów*

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## 1. Introduction

According to data from the literature [1–6], in the process of individual production it is required to have specialist knowledge, which guarantees precise requirements determination and ensures the appropriate level of quality. Production unitary is marked by a specific set of requirements for implementation. This is connected with an individual approach to individual order. The fact that the individual production is controlled through direct dialogue between the contractor and the client is an additional factor. Execution of prosthetic restorations by dental technician is this kind of production on special order.

The material selection is an increasingly more complex task, not only because of the very wide choice of material and availability of the offer, but mainly due to the consequences of an improperly used material. Digital material selection tools have a great potential not only in technical terms but also in evolution and development of the design process [7–9]. These tools give the possibility to know the basis of the project and create conditions for innovative performance of prosthetic restoration. There are many available databases of material, but it is important to create a database for familiar materials. Similar materials, whose characteristics differ from each other, however, are used in a specified field of science. In this case, creating a base of dental materials allows for the selection of materials from all engineering materials groups that are used at various stages of restoration manufacturing.

Creating a functional base of the dental materials selection is one of the demands of the rapidly growing market for these materials. Constantly striving to improve the quality of patients' (users') life through an increased number of aesthetic restorations makes patients want to be fully informed and, what is more, to be able to make their own decisions on the creation of their image (in this case their restoration) [8–10]. The functioning of the above database can have a significant impact on the flow of information between the three cells, which are the dentist, dental technician and patient. Implantation of a database in a dental office can also help to increase the confidence of patients to "their" dentists [9, 10]. The patients will be 100% informed what the price for the dental-prosthetic service includes and they will be able to decide on the possible reduction of costs by finding substitutes. The DeMISS base may become an essential tool for creating a clear and explicit material-processing-aesthetic orders. In order to create a useful and reliable database of commercial dental materials it is necessary to carry out research in the market of dental materials. It is obvious that if the database is to be created with proper acceptance of dentists and dental technicians, it will be necessary to carry out extensive research among these professional groups. To compile information on dental materials which are mostly offered to patients and most often used by dental technicians, an extensive survey should be created – all dental materials that are released for sale are under the strict control of the International Standards Organization (ISO) and the American Society for Testing and Materials (ASTM), which places high demands on the stage of material parameters determination [9, 10].

Creating the algorithm of searching and selection of proper dental materials involves carrying out multi-step trials research in dental practices and dental laboratories in order to improve the flow of information streams. Stage of the base synthesis process (e.g. dental materials integral selection system – DeMISS) would be carried out the external studies,

on a group of customers, i.e. patients who will be able to decide freely about the kind of materials their dentures will be made of.

## 2. Objective of the research

The aim of the research is to introduce the idea and primary project of the Dental Materials Integral Selection System (DeMISS), which will become a functional tool during the design stage of total and partial dental restorations. The idea of the system includes advanced control functions of the material choice from the point of view of construction materials requirements and expectations of both aesthetic and economic subjects. One of the elements of the system will also be the possibility of individual virtual designing of dental restorations by the dentist, dental technician and patient, based on the unit prices of necessary materials and based on labor coefficient required to create a supplement.

## 3. Characteristics of information stream flow

The main problem in the implementation of orders (restoration project) from the range of dental engineering, is the fact that there is a one-way flow of information. In this system, there are three cells: the customer (patient), dentist and dental technician (Fig. 1). In this system, the patient is in direct contact with the doctor who performs the treatment and decides on the type of required restoration [11–14]. The dentist forwards recommendation to the dental technician. In this system, the contact between the patient and the dental technician is completely omitted. This means that, in theory, the patient does not have a major impact on the type of order and has no possibility to submit requirements. The dentist is an intermediary in communication during the process of determining the details of project. It should be noted that, in most cases, the patient has no possibility of selecting operational parameters of restoration (the choice of materials and manufacturing techniques, taking into account the characteristics and prices of the final product) – therefore we refer to a one-way flow of information in the patient – dentist – dental technician system.



Fig. 1. The flow of information in the patient-dentist-dental technician system

It can be assumed that each of the participants of the system has its own requirements, expectations and knowledge. Fig. 2 presents the basic information (knowledge), requirements and expectations of the system elements (competencies of the dentist and dental technician have been determined on the basis of the framework of teaching faculties).

<b>Knowledge</b>	
<b>Dental technician</b>	<b>Dentist</b>
<ul style="list-style-type: none"> <li>- basic anatomy, physiology and first aid,</li> <li>- modeling and the drawing in dental technology,</li> <li>- dental technique,</li> <li>- orthodontics</li> <li>- extensive technical knowledge in the field of materials, processing techniques of materials - selection of materials, mechanical and chemical properties, surface treatment,</li> <li>- manual abilities,</li> <li>- sense of aesthetics,</li> <li>- technical and biotechnical sciences: computer science, information technology.</li> </ul>	<ul style="list-style-type: none"> <li>- basic biological sciences,</li> <li>- behavioral sciences</li> <li>- a wide range of medical knowledge: general medicine and surgery, pathology, microbiology, otorhinolaryngology, dermatology, epidemiology and pharmacology,</li> <li>- minimal technical knowledge in materials and manufacturing techniques,</li> <li>- technical and biotechnical sciences: computer science, information technology.</li> </ul>
↑	↑
<ul style="list-style-type: none"> <li>- precise execution of prosthetic work,</li> <li>- optimal cost of prosthetic work execution,</li> <li>- use of the best technology,</li> <li>- use of the best materials.</li> </ul>	<ul style="list-style-type: none"> <li>- professional approach to patient: empathy, care and concern for the patient,</li> <li>- use understandable phrases and vocabulary</li> <li>- knowledge of the medical aspects - the ability to diagnose and implement a medical service</li> <li>- compliance with the rules of hygiene,</li> <li>- the optimal price for the service,</li> </ul>
<b>Requirements patients (clients) against contractors</b>	

Fig. 2. Knowledge and requirements for contractors of prosthetic individual orders

In prosthetic orders, quite an interesting relationship occurs in the flow of information. The first key factor is the client (patient) that comes to a dental office to use medical services – diagnosis, treatment and denture fitting. The customer sets very high expectations of the service. The patient has direct requirements for the doctor to focus on the professional approach to the patient and to have wide knowledge of medicine as well as indirect demands on the dental technician during the implementation of the restoration project realization. The patient expects that its restoration will fulfill all the aesthetic requirements, will be made from the finest materials and by means of the best technology, while maintaining the best prices. Completion of an order with such a flow of information is difficult, because the dentist should have extensive knowledge of medicine, and only minimal knowledge of the materials and techniques used in dentistry. Thus, the dentist is not fully able to provide the information that for the patient may be the core of order. Technical information would help to make the right project. It should be noted that the dental technician does not have permission (the lack of legal provisions) to contact the patient, and the only unit of connecting the information flow in the patient – dental technician relation is the dentist. The patient does not have any information on the technical aspects of the production of the prosthesis and does not have any possibility to interfere in the project work [12]. It is worth emphasizing that the prices of dental restorations are determined not only by the type and size of the restoration, but also by materials selection (apparently similar

materials differ in performance characteristics, and consequently the price), technology and the use of technical devices. The use of modern techniques (computer-aided) and high standardization of work affects the final price. Therefore, the Dental Integral Material selection System (DeMISS) is very helpful for dental offices as a form of communication between the client and the contractor of prosthetic work [13]. The Dental Integral Material Selection System (DeMISS) is an innovative concept of communication in the plane of the patient-dental technician. The Fig. 3 presents the general scheme of action and the information flow during orders by the DeMISS system.

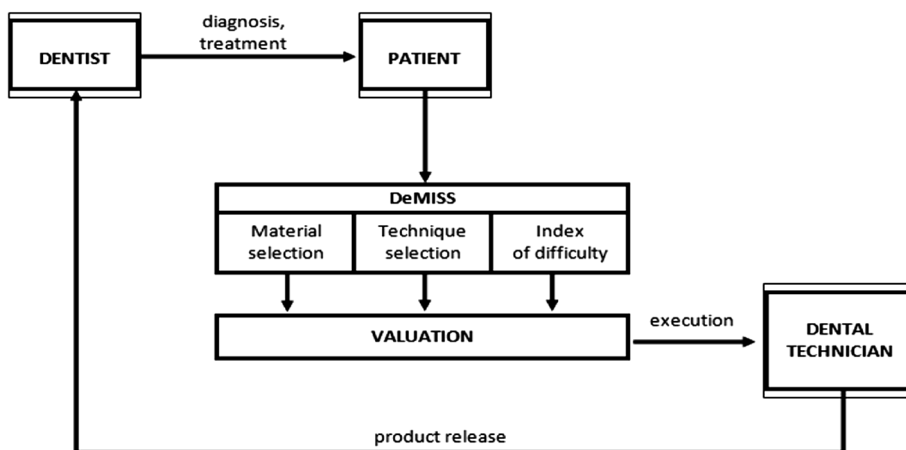


Fig. 3. General scheme of action and the information flow during orders by the DeMISS system

The use of the restorations self-designing system (DeMISS) does not force on the patient the knowledge of the basic principles of materials, techniques and their selection. The system is based on the clearly referred set of operating parameters. The system information shows the dependence between prices and durability of the products, and the cost of labor - factor of complexity (this factor should be calculated individually), based on the dental technician's skills presented in the database. Start of the DeMISS system in practice requires an empirical estimation of difficulty coefficients and the creation of a database of commercially available materials as well as techniques available to selected laboratories of dental technique. The proposed solution is a substitute for the flow of information between the patient and dental technician. It must be remembered that, according to the current law, the dental technician is not authorized to have a direct contact with the patient, who makes quick adjustment to special order requirements.

#### 4. Conclusion

The introduction of the system to dental offices allows the patient to select materials and techniques used during the manufacturing process of a dental supplement. It is a technical solution which increases the possibility of contact between the patient and dental technician.

The proposed systems (The Dental Integral Material Selection System – DeMISS) gives the patient the possibility to fully and directly express their expectations for the restoration without having to mediate (in this case the dentist is the intermediary). Such a system can positively affect the quality of services and overcome errors resulting from the improper flow of technical information during the ordering process.

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