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Protocols in classification of partially edentulous patients

Протоколи у класификацији крзубости

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SUMMARY

The paper discusses importance of application of protocols in modern dentistry. Literature data that include recommendations and consensuses in dental practice point out to their presence in available books, printed papers, reviewed journals and supplements in the form of expert group conclusions. It should be noted that the protocols most commonly rely on valid postulates of different branches of medicine, supported by specific conditions of the environment in which they are implemented. Additionally, in our settings, protocols applicable in dentistry are the result of requirements that should be met by institutions and practices to comply with renewable accreditation and through observing the recommendations given in the good clinical practice guidelines with different levels of binding obligations.

Certain protocols offer therapeutic modalities categorized into classes intended to help users to select appropriate treatments. Second segment of this paper addresses one of such protocols which classify partially edentulous patients. The accent is put on classification of partial edentulism recommended by the American College of Prosthodontists, which relies on four diagnostic criteria essential for therapeutic decision. Location and extent of edentulous areas, health of abutment teeth, occlusion model and characteristics of the residual ridge represent the parameters based on which four classes of partial edentulism of different complexity are defined. In this way, serious, comprehensive approach to the clinical status of the patients that, among others, assures, higher uniformity of professional attitudes in selection of therapeutic modalities has been offered to dental practitioners for the first time.

Keywords: protocols; classification of partial edentulism; diagnostic consistency

САЖЕТАК

Рад дискутује значај примене протокола у савременој стоматологији. Литературни подаци који обухватају препоруке и консензусе у стоматолошкој пракси говоре о њиховој присутности у доступним књигама, штампаним радовима у рецензираним часописима, и додацима часописа као закључци експертских група. Треба приметити да су протоколи најчешће ослоњени на валидне постулате различитих медицинских грана, помогнути специфичним условима средине у коју се имплементирају. Додатно, у нашим условима, протоколи у стоматологији, резултат су захтева које институције и праксе морају да испуњавају сходно обновљивој акредитацији, као и поштовања препорука које су дате у водичима добре клиничке праксе различитог нивоа обавезности.

Поједини протоколи нуде терапијске модалитете који се категоризују у класе, помажући корисницима у избору правог третмана. О једном од таквих протокола који класификује крезубе пацијенте, говори други део рада. Акцент је на примени класификације крезубости коју је препоручио Амерички колеџ протетичара, а која се ослања на четири дијагностичка критеријума, есенцијална за терапијску одлуку. Локализација и величина безубих поља, стање здравља зуба носача, модел оклузије и карактеристике резидуалног гребена су параметри који су дефинисали четири класе крезубости различите сложености. Тако је, по први пут, стоматолошкој пракси понуђен озбиљан, свеобухватни приступ клиничком статусу пацијента, који обезбеђује, између осталог и униформније стручне ставове у избору терапијских модалитета.

Кључне речи: протоколи; класификација крезубости; дијагностичка конзистентност.

ABOUT PROTOCOLS

Protocols are exceptionally important in contemporary medical and dental practices. Standard definition that describes practical clinical guides, although developed back in 1990, has remained as actual as ever. Field and Lohr [1] stressed that protocols represent “systematically developed determinants that help practitioners and patients in making decisions on appropriate health care in specific conditions “.

More specifically, task of a protocol is to identify, summarize and evaluate the most contemporary knowledge and facts related to prevention, diagnosis and treatment of the given health problem. Protocols define the most important issues related to clinical practice, taking into account differential diagnoses and consequences of possible decisions. Numerous protocols offer alternative therapeutic modalities categorized into classes, essentially helping users to make appropriate choice of treatment [2, 3].

Additional objectives that may be accomplished by implementation of protocols include: standardization of medical and dental care, continuous improvement of care, reduction of different levels of risk (patients, physicians, insurance services), as well as achievement of higher quality of balance between expenses and medical parameters of treatment (efficacy, specificity, sensitivity, decisiveness, etc.).

Unfortunately, practical implementation of protocols is not problem-free. It is considered that as much as 20% of strict recommendations, particularly if they are not based on experimental evidence, but only given as opinions, are being revoked [4]. Moreover, clinical practice guidelines, show methodological problems and conflicts of interest. Their quality significantly varies, particularly if they are published *on-line* without reference to the existing standards [5]. Less frequently, the protocol recommendations are more strict and more demanding than the facts that support them [6].

Usually, the protocols are developed and verified by national and international associations or governmental bodies. Additionally, special software packages are also available (*guideline execution engines*) that are developed to facilitate usage of medical protocols in electronic recording system. Regarding the former, concern related to timely improvement of the existing protocols appears to be reasonable, with special focus on adoption of multidisciplinary expert opinions in combination with scientific support [7]. Literature data that include protocols, recommendations and consensus in dental practice are diverse. Most commonly they may be found in the available textbooks [8, 9] and printed papers in the reviewed journals as conclusions of expert groups and similar. They cover all dental specialities with basic information on the routes of infection transmission (HIV, HBV), control and standard precautions (protection of dentists and patients), protocols of effective hygiene, asepsis and sterilization (type, instruments, duration, monitoring) and binding procedures related to storage or medical waste [10]. It is a fact that all these recommendations significantly rely on valid postulates from different branches of medicine (epidemiology, hygiene, infectious diseases), supported by specific environmental conditions in which they are implemented. On the other hand, certain areas, such as esthetic dentistry and oral implantology, offer protocols adopted on consensus conferences, as well as recommendations of the professional associations. It is important to mention some of them, without which, contemporary practice would not be rationally sustainable: recommendations related to clinical procedures based on which esthetic rules related to placement of implants are defined [11],

conditions and significance of immediate implantation [12], protocols in application of cemented and screwed implants [13], recommendations on management of edentulous patients determined by different parameters [14] as well as similar recommendations with longitudinal *evidence based* data [15-21] (Figure 1).

In our settings, dental protocols are the result of requirements that must be met by institutions and practices to comply with renewable accreditation and through observing the recommendations given in the good clinical practice guidelines with a different binding level. (a, b, c).

It should be stressed that guidelines and recommended protocols represent only one of the options for improvement of general quality of health protection and care. They must not be considered to be „magic solutions“ of numerous problems, but instead, they should be understood, used and combined with the existing professional quantum of knowledge and overall skill.

To this end, objective of the authors is to inform the readers in the following segment of the paper on the most recent partial edentulism classification system that can also be regarded as contemporary protocol in the field.

CLASSIFICATION OF PARTIAL EDENTULISM

Partial edentulism is a syndrome of loss of one or more permanent teeth in the upper or lower jaw dental arch in adults [22]. It is most commonly caused by caries, periodontal problems, trauma or tumors. Clinically, partial edentulism results in tilting and displacement of the adjacent teeth, eruption of antagonist, altered speech and appearance of the patient, temporomandibular dysfunction, and compromised quality of life. Continuous loss and degradation of the bone as well as changes on the remaining teeth make rehabilitation of these patients rather complex [23, 24].

The profession is faced with existence of different methods of classification of partial edentulism. Majority of classifications relies in practice on arrangement of the remaining teeth and edentulous areas in the mouth, which is considered to be relatively simplified approach. On the other hand, mathematically calculated number of combinations of the lost teeth in both dental arches exceeds 65,000, and therefore, having in mind these numbers, applicable topographic classifications may be considered clinically appropriate [22, 24].

However, in spite of the advantages of these classifications, such as: easier communication between the practitioners, technicians and dental industry as well as establishment and respecting of doctrinal attitudes in treatment of partial edentulism, it appears that contemporary dental practice, rightly considers topographic classification of partial edentulism insufficient. Major objection to

numerous classifications of partial edentulism presented by renown authors (Cummer, Kennedy, Rumpel, Bailyn, Neurhor, Mauk, Wild, Betelman, Friedman, Austin-Lidge, Skinner, Avant, Miller, Costa, Kobes) [23, 25] is based on the fact that classification of partial edentulism does not include information related to health status of the remaining teeth, antagonist teeth, residual ridges as well recommendations on possible therapeutic solutions (Table 1). Therefore, it is reasonable to expect from the contemporary classifications to offer to the practitioners greater number of useful, pragmatic information. Unfortunately, unnecessary complexity of classifications designed in this way may be confusing and nonapplicable in everyday practice, which is fast, efficient and cost-effective. With this regard, practical rules that should be followed in such cases include: simplicity, acceptability and recommendations on possible treatment.

It is considered that ideal classification of partial edentulism should contain information that illustrate objective status of the patient and offer optimal therapeutic solutions. In this way, defined information may be selected in electronic diagnostic and procedural bases of national significance and improve to the sufficient extent effective monitoring of patients' health status.

One of the comprehensive, more recent classification systems is presented by American College of Prosthodontists in 2002. [26]. The main idea of the classification was the possibility to help practitioners to define appropriate treatments to be recommended to partially edentulous patients. The system uses four basic criteria and their diversity to divide all partially edentulous patients in four classes, where Class I includes simple and Class IV exceptionally complicated clinical cases of partial edentulism. Advantages of this layered classification which takes into account location and size of the residual ridge, its characteristics, health status of the residual teeth as well as occlusal characteristics in partially edentulous patients are evidenced in a number of segments: 1. improvement of professional communication and consistency in therapeutic decisions; 2. objectification of the methodology used for follow-up of patients within the educative process; 3. standardized criteria necessary for evaluation of treatment/research outcomes and 4. improvement of diagnostic procedures and further development of organized simplified help in decision-making (Figure 2) [27].

REVIEW OF DIAGNOSTIC CRITERIA AND CLASSES OF PARTIAL EDENTULISM ACCORDING TO AMERICAN COLLEGE OF PROSTHODONTISTS (ACP)

PARTIAL EDENTULISM CLASS I

Partial edentulism Class I is characterized by the most favorable location and extent of edentulous area, healthy retention teeth (abutment teeth), harmonious occlusion and favorable characteristics of the residual ridges.

Location and extent of edentulous area

Edentulous area is restricted only to one dental arch. It may be located in the frontal segment of the upper jaw, where it does not include more than two incisors, or in the frontal segment of the lower jaw, when it does not include more than four incisors. If the edentulous area is located in the lateral segment of the upper or lower jaw, it should not involve more than two premolars or one premolar and one molar.

Health status of retention teeth (abutment teeth)

Health status of the remaining teeth that may be used as retention teeth for fixed or removable restorations is satisfactory and thus preprosthetic tooth preparation is not recommended, regardless of its type.

Occlusion model

Occlusion is stable and physiological, no disharmony between anatomical and physical determinants is evidenced. The patients belong to skeletal class I and dentoalveolar class I, and thus preprosthetic therapeutic interventions (selective grinding) is not recommended.

Characteristics of residual ridge

Patients with partial edentulism class I show morphological features of the residual ridge which make good support for denture base preventing horizontal and vertical movements of the removable restoration; at the same time, optimally located muscle attachments help stabilization and retention of the denture base. The upper jaw belongs to type A while lower jaw can be type A or B. While considering characteristics of the residual ridge, the following should be determined on the OPT image: height, that should be ≥ 21 mm when measured on the lowest position on the mandible, width and shape of the ridge if implant treatment is planned. Implantation procedure should be agreed with the surgeon with previous 3D diagnosis of jaw bone quality and other measurements on the jaws (proximity of sinus cavities and mandibular canal) [14, 27-29].

PARTIAL EDENTULISM CLASS II

This class of partially edentulous patients is characterized by visible changes on some segments of orofacial system necessitating certain type of preprosthetic preparation. In practice, it means appropriate preparation of the patient (recognized by the dentist), which at the same time provides conditions for further quality prosthetic rehabilitation.

Location and size of edentulous area

Edentulous areas, found in one or both tooth arches are of the same size as in partial edentulism class I. Additionally, the situation is complicated by lack of canine teeth in the upper or lower jaw, and thus proposed therapeutical modalities become more complex for the patients and more difficult for the therapists.

Health status of retention teeth (abutment teeth)

Retention teeth in one or two sextants have insufficient tooth substance to retain fixed restorations. In order to include such patients in the prosthetic treatment, different interventions are required: endodontic, periodontal or orthodontic procedures. Topographically, sextant represents a part of the tooth arch, and thus maxillary and mandibular tooth arches may be divided into 6 parts – two left and two right posterior sextants, and two anterior sextants. Right posterior maxillary sextant includes teeth from 18 to 13, the left posterior from 23 to 28 while anterior maxillary sextant comprises teeth 13 to 23. Right posterior mandibular sextant includes teeth from 48 to 43, posterior left from 38 to 33 and anterior mandibular sextant covers teeth 33 to 43.

Occlusion model

It is observed that upon functional movements of the lower jaw, partially edentulous patients with skeletal class II show occlusal difficulties. Most commonly, they may be eliminated by well-planned selective grinding before prosthetic treatment. The patients belong to skeletal class I and dentoalveolar class I.

Characteristics of residual ridge

Morphological features of the ridge provide good retention and stabilization of the denture base, preventing its vertical and horizontal movements. Height of the residual ridge is 16-18mm, measured at the least vertical height of the mandible on a panoramic radiograph. Both jaws belong to type A or B.

PARTIAL EDENTULISM CLASS III

Partial edentulism Class III shows severe changes in the stomatognathic system. Their complete management requires multidisciplinary approach and consultations with different dental specialists. Symptoms frequently encountered in this group of patients include: reduced interocclusal space, enlarged tongue, signs of TMD, xerostomia, hyperactive gag reflex and other. Different preparation procedures, such as multiple extractions, alveoloplasty and placement of implants are frequently necessary.

Location and size of edentulous area

Edentulous areas are found in one or both tooth arches. They are most commonly distributed in the posterior segments of the upper or lower jaw, include three or more missing teeth or two missing molars. Edentulous areas may also be anterior in the both jaws, extending to three or more missing teeth.

Health status of retention teeth (abutment teeth)

Potential abutment teeth for fixed restorations or retention teeth for partial restorations can not sustain additional load in the initial phase of examination; therefore, they must be prepared for the planned tasks. Their preparation is endodontic, periodontal or orthodontic in three sextants. If the performed preparation proves to be successful, teeth are being designated as prognostically relatively good.

Occlusion model

Occlusal impediments resulting from disharmony of occlusal determinants are present in patients with partial edentulism class III. They can not be eliminated by selective grinding and thus reconstruction of the occlusal plane is required however without alteration of the occlusal vertical dimensions. These patients most commonly belong to the skeletal class II, although they may also be class I or III.

Characteristics of the residual ridge

Due to its shape and dimensions, residual ridge of class III partially edentulous patients provides minimal conditions for stability and retention of the prosthesis while functional help of the muscles is moderate. Height of the residual ridge is 11 to 15 mm measured at the least vertical height of the mandible on a panoramic radiograph. Both jaws belong to type C.

PARTIAL EDENTULISM CLASS IV

This class of partial edentulism is characterized by significant changes in all segments of the stomatognathic system. The patients necessitate multidisciplinary preprosthetic treatment. However, even after completed preparation, prognostic success of rehabilitation of these patients is uncertain. The former is supported by complexity of numerous surgical procedures that may be involved in preparatory activities: alveolar bone augmentation, correction of dentofacial deformities, implant placement, vestibuloplasty, etc. Clinical picture is frequently complicated by lack of interocclusal space, paresthesia, presence of congenital or acquired defects, systemic diseases or oncological sequelae. All this is indicative of complex and high-risk prosthetic rehabilitation of these patients.

Location and size of edentulous area

Edentulous areas are found in both dental arches, their size is different and they are rather extensive. Edentulous areas are frequently associated with acquired or congenital maxillofacial defects.

Health status of retention teeth (abutment teeth)

Retention teeth arranged in four or more sextants are not capable to sustain additional loads and thus they cannot support fixed restorations. They necessitate different types of adjunctive odontology, with their quality still remaining uncertain.

Occlusion model

In class IV patients with partial edentulism instable occlusal relations are diagnosed. Vertical occlusal dimensions is changed, most commonly reduced. Preliminary reconstruction should start from as detailed as possible analysis of the study model on an articulator, and different forms of preparation should be suggested to the patient. Reconstruction of the complete existing occlusal model is required in final therapy along with correction of the vertical dimension. Skeletal class of the patients is II/2 or III, which additionally makes prosthodontic therapy more complex, particularly if orthodontic rehabilitation or orthognathic surgery are required.

Characteristics of residual ridge

Residual ridge size and design do not contribute to restoration stability, since both vertical and horizontal movements of the denture base are expected. Additionally, location of muscle attachment also significantly influences retention of the prosthesis. Height of the residual ridge is less than 10 mm, measured at the least vertical height of the mandible on a panoramic radiograph. Upper jaw belongs to type D while lower jaw is classified as type D or E. Preprosthetic surgical treatment is necessary.

All global information obtained upon examination of the patient are entered into the boxes of the worksheet designated for each criterion. By filling out of the table prosthodontic diagnostic index (PDI) for partially edentulous patients is created. In this way simple, professional communication is achieved, including issues related to complicated clinical symptoms. It should be stressed that regardless of the future suggested therapeutic modality, diagnostic level of the patients must not be changed (class categorization). The approach is considered correct when the situation achieved after appropriate preparation is assessed upon new examination and the patient is assigned to other class accordingly. Esthetic demands as well as presence of TMD signs and symptoms increase complexity of the class (applicable to classes I and II). Establishment of optimal oral hygiene regimen is a prerequisite for diagnostic examination (Table 2).

If the patient's upper jaw is edentulous and the lower one is partially edentulous, classification is performed for each arch separately, and thus upper jaw is classified according to classification applicable to edentulism [27, 28]. Relatively frequent clinical situation characterized by edentulous lower jaw in combination with partially edentulous upper jaw or even completely dentate upper jaw is considered exceptionally complicated situation with uncertain prognostic outcome and it is categorized as class IV in both systems.

It should be noticed that although the system apostrophize significance and role of each individual variable as a valid criterion, finally determined class corresponds to the factor of greatest complexity. Classification established in this way results in creation of individual PDI profile, which is of great help in defining of prognosis and plan of treatment in each patient [30].

Additionally, it is evident that ACP classification system provides optimal space for organized clinical observations in which considered variables are systemized in ascending order of complexity, depending on the case of partial edentulism. With this respect, it is possible to suggest different types of preparations and referral to other specialties in order to assure long-term success of final prosthetic rehabilitation.

Despite numerous advantages, the proposed classification system appears to be complex in some way. It necessitates experienced prosthodontist who must be familiar with the classification protocols related to edentulous and partially edentulous patients as well as completely dentate patients in order to systemize correctly criteria important for partial edentulism [27, 31]. In this way, additional time is dedicated to conversation with patients (time consuming procedure), processing of the collected data and keeping of documents.

Regardless of the above statement, it should not be forgotten that modern dentistry largely supports all forms of wants-based service (custom driven). Therefore, success of outcome of practical application of the protocol may be measured to a large degree by satisfaction of the patients. It has been known that some forms of confirmation of application of edentulous patient classification and resulting therapeutic success are subject of university projects [30, 32, 33, 34].

As a conclusion of the current issues, is the fact, that application of "instant" therapeutic solution in the everyday dental practice, does not always mean the best options for the patient. Therefore, only the respect for broadly defined protocol positions, can result in the detection of optimal modalities in solving complex professional problems.

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Table 1. Classification of partial edentulism according to different authors and parameters

Year	Name of author	Criteria
1921	Cummer	Topographic, therapeutic
1923	Kennedy	Topographic
1939	Martin	Topographic, biological
1940	Swenson Terkla	Topographic
1949	Wild	Topographic
1955	Eichner	Number of occlusal contacts
1958	Applegate	Topographic, therapeutic
1959	Skinner	Topographic
1961	Osborne	Therapeutic
1964	Friedman	Functional
1967	Eichner	Number of occlusal contacts
1973	Hoffman	Tooth position
1975	Kerlheinze Körber	Biophysiological, therapeutic
1979	Kobes	Topographic
1981	Fabian	Teeth number and position
2002	ACP	Clinical situation

ACP – American College of Prosthodontists

Table 2. Prosthodontic diagnostic index (PDI) according to the American College of Prosthodontists (ACP) recommendations

Criteria	Class 1	Class 2	Class 3	Class 4
Location and extend of the edentulous space				
On a single dental arch	✓			
On both dental arches		✓		
Extended edentulous space (more than 3 teeth missing)			✓	
Guarded prognosis				✓
Maxillo-facial defects				✓
Abutments condition				
Ideal or minimally compromised	✓			
Moderately compromised		✓		
Substantialy compromised			✓	
Severily compromised				✓
Occlusion				
Ideal or slightly affected	✓			
Moderately compromised		✓		
Substantialy compromised			✓	
Severily compromised – changes in vertical dimension				✓
Residual ridge				
Class 1	✓			
Class 2		✓		
Class 3			✓	
Class 4				✓
Situations with guarded prognosis				
Oral manifestations of general diseases				✓
Maxillo-mandibular dyskinesia and/or ataxia				✓
Refractory patient				✓

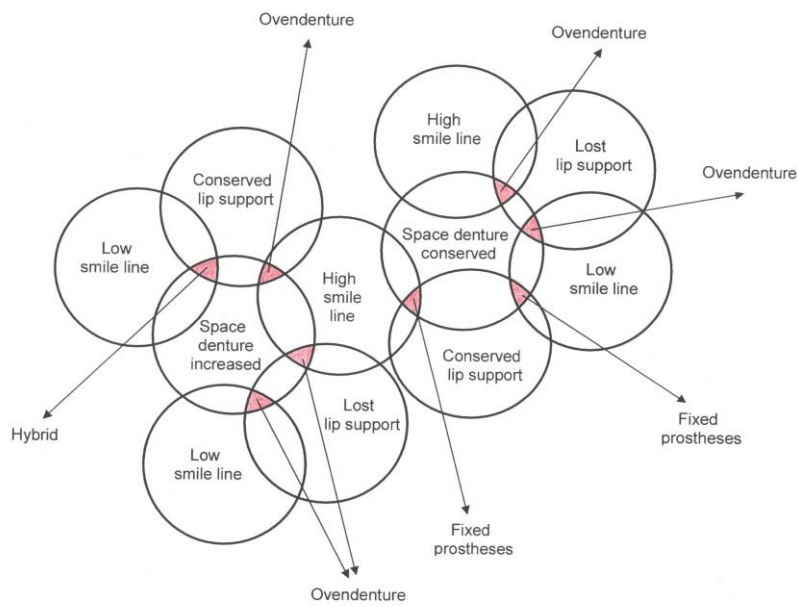


Figure 1. Recommended therapy in combination of three prosthetic parameters [14]

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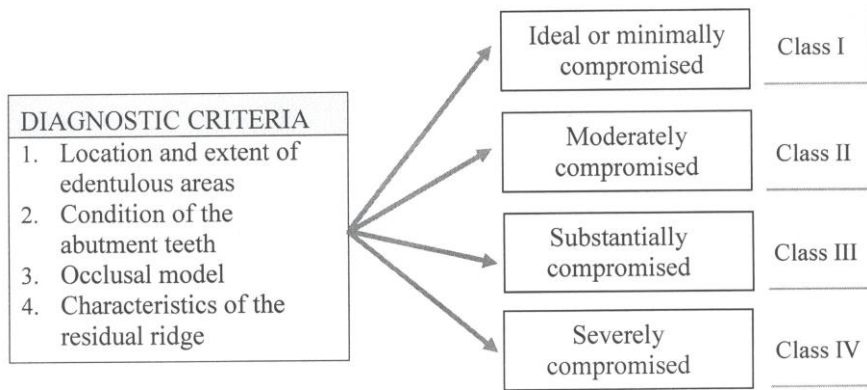


Figure 2. Criteria in classification of edentulous jaws [27]

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