ЗМІСТ

Stomatology: in 2 books. Book 1: textbook

Про книгу

The textbook presents modern aspects of clinical materials science, diagnosis, clinical pattern and treatment methods for teeth and dentition defects, advanced technologies for prosthetic appliances manufacturing, the issues on diagnosis, treatment and prevention of common dental pediatric diseases, provides current information regarding practical cases in dental prosthetics, pediatric dentistry and orthodontics. The textbook is intended for use by dental specialists, internship dentists, undergraduates, dental residents, students of postgraduate education.

STOMATOLOGY

TEXTBOOK

IN 2 BOOKS

BOOK 1

Edited by
Professor **M.M. ROZHKO**

APPROVED by
the Ministry of Health of Ukraine
as a textbook for doctors
attending postgraduate education
establishments (faculties) of the
Ministry of Health of Ukraine
specialising in dentistry

Kyiv
AUS Medicine Publishing
2020

UDC 616.3
LBC 56.6ya73
S81

Approved by the Ministry of Health of Ukraine as a textbook for doctors attending postgraduate education establishments (faculties) of the Ministry of Health of Ukraine specialising in dentistry (letter No. 08.1-30/30226, 23 November 2016)

Authors:
M.M. Rozhko, Z.B. Popovych, V.D. Kuroiedova, T.M. Dmytryshyn, I.V. Paliichuk, H.S. Ornat, L.I. Pelekhan, H.Z. Parasiuk, H.V. Kindrat, H.M. Havryliv, S.V. Kosenko, Ye.V. Bezvushko, I.Z. Detsyk, V.A. Labunets, T.V. Diieva, K.M. Kosenko, L.B. Halych, V.I. Bida, O.V. Pavlenko, M.Ya. Nidzelskyi, V.I. Hryzodub, P.M. Skrypnikov, V.M. Mudra, A.M. Potapchuk, V.P. Nespriadko, M.M. Pokrovskyi, Yu.V. Vovk, S.K. Surzhanskyi, M.I. Dmytrenko, O.M. Rozhko, R.M. Nazaruk, H.M. Davydenko, Ye.D. Babov, B.M. Mirchuk, O.A. Hlazunov, M.S. Drahomyretska, L.O. Khomenko

Reviewers:
T.P. Skrypnikova — Candidate of Medical Sciences, Professor of the Department of Postgraduate Education of Dentists, Ukrainian Medical Stomatological Academy, Honored Doctor of Ukraine;
N.I. Smoliar — Doctor of Medical Sciences, Professor of the Department of Orthodontics, Danylo Halytsky Lviv National Medical University, Honored Worker of Science and Technology of Ukraine

English language editor:
I.V. Rozhenko, Ukrainian Medical Stomatological Academy

Stomatology : textbook : in 2 books. Book 1 / M.M. Rozhko, Z.B. Popovych, V.D. Kuroiedova et al. ; edited by M.M. Rozhko. — Kyiv : AUS Medicine Publishing, 2020. — 792 p. : color edition.
S81 ISBN 978-617-505-828-2

The textbook presents modern aspects of clinical materials science, diagnosis, clinical pattern and treatment methods for teeth and dentition defects, advanced technologies for prosthetic appliances manufacturing, the issues on diagnosis, treatment and prevention of common dental pediatric diseases, provides current information regarding practical cases in dental prosthetics, pediatric dentistry and orthodontics.

The textbook is intended for use by dental specialists, internship dentists, undergraduates, dental residents, students of postgraduate education.

UDC 616.3
LBC 56.6ya73

ISBN 978-617-505-828-2

CONTENTS

PREFACE

The National Healthcare Reform Strategy in Ukraine does not leave aside dentistry. The reform directly concerns the system of postgraduate education.

The transition of medical education and professional development of GP dentists to the new learning environment requires qualified methodological support of the continuous learning process. The aim is to train not only single-discipline specialists, but also GP dentists. Dental professionals should acquire a large volume of knowledge dealing with all branches of dentistry. This prompted us to create and reprint the textbook "Stomatology" for the postgraduate education.

We attempt to combine clinical and laboratory stages of fixed and removable dentures manufacturing in orthopedics, which will be of great theoretical and practical importance for dentists in their achievements during training and practical activities. Compared with the previous edition, this publication contains information about manufacturing techniques and treatment with metal-free restorations and veneers.

Chapter "Pediatric Dentistry" highlights the current views on the etiology, pathogenesis and treatment of caries. Special attention is paid to such topical issues of clinical pediatric dentistry as modern methods and approaches to the treatment of pulpitis and periodontitis in children. Presented information deals with the diseases a dentist faced in his practice.

The new chapter on orthodontics was also introduced. It is due to the constantly growing dynamics of dental abnormalities and deformities among children in Ukraine. Necessary information for dentists' practical use in their daily work, namely, the ability to administer timely preventive measures, diagnose and manage the specialized treatment in the medical establishments is presented.

CHAPTER 1
PROSTHETIC DENTISTRY

MATERIALS SCIENCE IN PROSTHETIC DENTISTRY

The term "materials science" combines a variety of disciplines related to the information about materials used in the stages of denture designs manufacturing. Materials science is based on physics and chemistry. In particular, it examines the properties of metals and their processing, the properties of synthetic materials of inorganic and organic nature, obtaining and especially the use of aluminosilicates: ceramics, glass, cement, etc.

Materials science is a part of developing prosthetic dentistry: new materials, devices, technologies are being developed. Therefore, there is an effectiveness of providing prosthodontic dental care. It is determined not only by the qualification of the dentist and the dental technician, but also by the properties and quality of the materials used.

The main directions in which new materials are being developed are related to the maximum provision of biological inertness, corrosion resistance, high durability, aesthetic requirements, reproduction of individual naturalness, etc.

The modern market of dental materials is provided by such world wide manufacturers:

— in Europe: Heraeus Kulzer, Vivadent, Vita, Ducera, Degussa, Voco, Kettenbach, ESPE, Bego (Germany), SDI (Austria), Spofadental (Czech Republic), VladMiVa (Russia), Stoma (Ukraine);

— in Asia: GC, Shafu, Noritake, Hatakouyama (Japan);

— in the countries of South and North America: 3M, Kerr, Dentsply, Jeneril / Pentron, Ultradent, Bisco, Phoenix Dental.

REQUIREMENTS TO DENTAL MATERIALS AND THEIR PROPERTIES

The oral cavity is an aggressive environment for dentures; they have a complex of physical, chemical and biological factors. Prosthodontic constructions are subjected to the considerable dynamic, mechanical loading during chewing of food.

Dental materials made of orthopedic appliences affect the tissues of the prosthetic bed and area. Due to the negative influence of many construction materials, the requirements for them have been recently increased.

Materials used to manufacture dentures must meet certain requirements:

— be harmless to the organism;

— be chemically resistant to the environment of the oral cavity;

— have high physical and mechanical properties (hardness, durability, elasticity, plasticity, heat resistance);

— have high technological properties (small shrinkage, slipperiness and spillage);

— match the color of substituting tissues.

The choice of materials for prosthodontic appliencies is a crucial moment, because those influences that arise in the oral cavity are characterized by a dynamic, constantly changing nature and depend on the content of food, the state of the nervous system. All materials should have elasticity, which excludes the occurrence of residual deformation.

The influences, which constantly act in the oral cavity, lead to the erosion of the materials from which prostheses are made. The hardest substance in the oral cavity is the enamel of the teeth, which is often compared with the hardness of the materials. These characteristics should be known when using a combination of different materials such as gold, artificial acrylic teeth, metal frames and ceramic lining, etc.

Materials used in the intermediate stages for the dentures manufacturing should not cause harmful effects to the body of the dental technician and the dentist. If it is impossible to do without harmful substances, it is necessary to follow safety measures. Acid vapors, methyl methacrylate, lead, mercury, epoxy resins are considered to be harmfull.

In order to avoid occupational intoxication when using such substances in the laboratories a ventilation system with a ventilation hood is set and personal protective equipment is used: masks, glasses, aprons, gloves.

The main properties of materials are mechanical, chemical, physical and technological. Let's examine them in more detail.

Mechanical properties are the ability of materials to withstand the deforming and destructive effects of external mechanical forces in combination with the ability to elastic and plastic deformation in this case. The mechanical properties of materials include: hardness, strength, elasticity, ductility, density, material fatigue, hardness.

Deformation properties include elasticity, stiffness and softness, relative elongation during stretching and ductility. There are several types of strength: tensile strength, compression, bending, hardness, weariness, wear resistance, brittleness, and toughness.

Hardness is the ability of the body to resist in case of penetration into its surface of another body. Hardness is studied by the ability of the material to resist wearness. Hardness is determined according to Brinell method or according to the methods of Vickers, Rockwell, and Shore with the use of microhardness meter.

It is advisable to use Brinell method when the steel ball is not deformed when it is squeezed into the surface of a tested material, i.e the material is not too solid. In the investigation of solid materials, Vickers method with a diamond pyramid or the

Rockwell method with a diamond cone is used. According to Shore method, the hardness is determined by means of scleroscope, fixing the elastic response of the investigated material on the device. The use of microhardness meters is useful in determining the hardness of superfine surface layers of the material.

Strength is the ability of the material to resist the action of the external forces, without breakage and deformation. Usually, the strength of the material depends on its nature, structure, size of products made of it, the size of the load and the nature of the action on it. The minimum load, which breakes down the integrity of the material, is the measure of its durability. The strength of this material is the ratio of the value of the minimum load to the cross-sectional area of the part.

The increase in strength can be achieved in different ways: in metals — heat treatment by rolling, doping, cold work hardening; in plastics — introducing a crosslinker polymer into molecule and obtaining a copolymer with increased mechanical properties.

Elasticity is the ability of a material to change shape under the action of external load and restore it after eliminating this load. An example of the elastic properties of the materials is the bend of the steel wire, the stretching of the metal spring, the compression and deformation of the prosthesis from plastic or silicone impression paste. After the cessation of force, all these bodies become preformed. The magnitude of the force should correspond to the elasticity. The boundary of the elasticity is the ratio of the magnitude of the maximum load to the cross-sectional area of the sample, after elimination of which the sample is able to restore its original form.

Plasticity is the ability of a material, without breaking down, to change the shape under the action of the load and to store it after the cessation of the load. Such materials as wax, gypsum, metals have plasticity. Plasticity is provided by various technological processes.

Thus, to obtain the metal of maximum plasticity, it is burned off; ductility of wax increases during heating, gypsum — in mixing with water. The plasticity of the material reduces resistance to the deformation.

Fatigue of materials. Under the influence of a large number of cyclic loads on the prosthesis, destruction of the material is possible, which is called the destruction from fatigue. The destructive tension (fatigue limit) in this case is much lower than the tensile strength. The causes of the fatigue are various changes in the shape of parts: abrupt change in thickness, cuts, and cracks on the surface, pores, which causes concentration of tension. Cracks of the fatigue appear around these areas. In order to avoid such negative phenomenon, it is necessary not only to select stronger materials, but also to strengthen the surface of the product. This is achieved by chemical-thermal, mechanical processing and hardening with high-frequency currents. Such measures allow increasing the fatigue limit.

Stiffness of materials is the ability of structural elements to resist the action of external forces. It should be remembered that materials during the use are subjected not only to destruction, but also to deformation. Therefore, for any material

MANUFACTURE OF INLAYS

A dental inlay is a micro-prosthesis that restores impaired integrity of the tooth, is made outside the oral cavity from various materials. Depending on the placement in hard tooth tissues, inlays are divided into 4 groups. Group I includes micro-prostheses, located only inside the hard tissues of the tooth (*inlay*) (Fig. 164); group II includes micro-prostheses that cover the occlusal surface of the tooth and simultaneously are introduced into a different depth of its hard tissues (*onlay*) (Fig. 165).

Group III consists of micro-prostheses which cover the most of the external surface of the tooth crown (*overlay*) (Fig. 166).

Group IV includes any micro-prostheses from the first three groups, which are additionally fixed in the hard tissues of the tooth or in the crown channel applying different pins (*pinlay*) (Fig. 167).

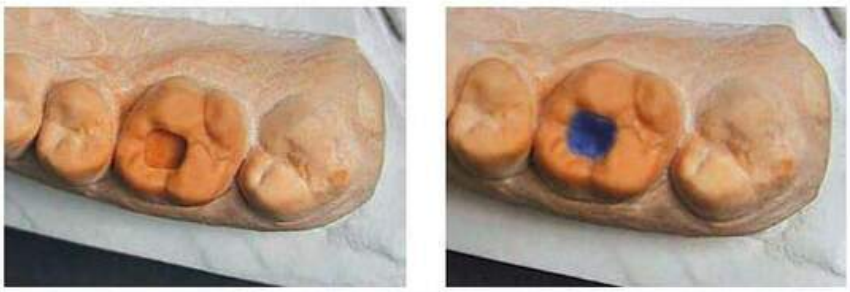

Fig. 164. **I group inlay**

Fig. 165. **II group inlay**

Fig. 166. **III group inlay**

Fig. 167. **IV group inlay**

For making inlays, golden alloys of medium and high hardness (750 ‰), cobalt-chromium, silver-palladium, titanium alloys, stainless steel, acrylic plastics, ceramic masses are used.

Manufacturing of one-piece stump inlay applying direct and indirect methods

In case of the complete destruction of the tooth crown part and preservation of the root there are two methods of one-piece inlays manufacturing: the direct one — in the oral cavity and indirect — in the dental laboratory. An inlay is a prosthesis, used for the anatomical shape restoration and replacement of defects of dental hard tissues. The teeth destruction is caused by caries, pathological abrasion (attrition), chronic trauma, non-carious lesions. One-piece inlay has replaced the structures with pin teeth, which were widely used in the 60—70s of the last century. The most common is the manufacture of inlays for the anterior group of teeth, especially lateral incisors, as well as stump inlays for other groups of teeth.

The manufacture of inlays is indicated in case of destruction of more than 1/3 of the tooth crown part, that is, the index of tooth occlusal surface destruction is more than 30 %. Prosthetic rehabilitation of devitalized teeth is possible only in the absence of changes around apical periodontium. In the presence of periapical foci of chronic inflammation, mandatory sanation is required. It is important that the preparation of the root part of the tooth was made at least 1/3 of the root length. The objective dental X-ray will simplify and improve the efficacy of the work.

The constructive peculiarity of the structure of one-piece stump inlay is the presence of the intra-root part (Fig. 168, *a*) and the stump of the destroyed tooth (Fig. 168, *b*). The use of one-piece stump inlay makes it possible to manufacture any structures of non-removable dentures, and, if necessary, to replace them, which is impossible while using pin teeth.

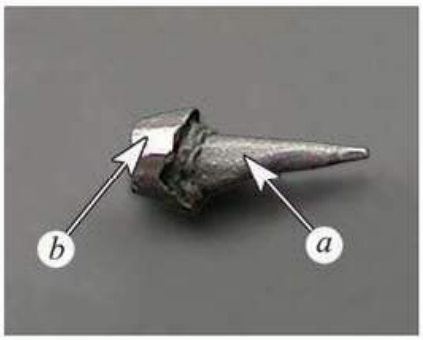

Fig. 168. **One-piece stump inlay:**
a — intra-root part; *b* — stump of the restored tooth

During the manufacture of one-piece stump inlays, the clinical and laboratory stages are carried out according to direct method with the following procedures:

Clinical stages	Laboratory stages
I. Check-up and examination of the patient. Determination of prosthetic diagnosis. Treatment planning. Preparation of the root part of the tooth for one-piece stump inlay. Modeling of inlay with wax "Lavax" in the oral cavity. II. Fitting the inlay in the root cavity, checking of the occlusal relations. III. Fixing of inlay	I. Replacement of wax with metal in casting lab. Processing of one-piece stump inlay

The clinical stage of the inlay manufacture according to the direct method begins with the examination of the patient, oral cavity examination, instrumental study, determination of the work volume. Preparation for one-piece inlay is performed with diamond tools at low rpm (30—40 thousand revs). For the work on the upper jaw it is expedient to use a direct micro-motor tip, on the lower one — an angular tip and sharp-pointed diamond heads. The final stage of preparation can be carried out with turbine burrs with fine diamond coating for smooth surfaces.

The root thickness should be not less than 1 mm; excessive thinning of the walls can cause wedging out and split of the root. After the formation of the pre-cervical area, gum retraction is sometimes performed (Fig. 169).

After preparation, the cavity is cleaned, washed, dried and modeling of the inlay with wax "Lavax" is started. The stick of "Lavax" is softened over the flame of a spirit lamp, a sharp cone of wax is formed and the impression of the tooth root cavity is formed carefully. The correctness of the taken impression is checked by removing the wax stick and visual assessment of the taken impression correspondence to the root cavity of the tooth (Fig.170).

Fig. 169. **Preparation of the tooth root cavity for one-piece stump inlay**

Fig. 170. **Reproduction of the tooth root cavity**

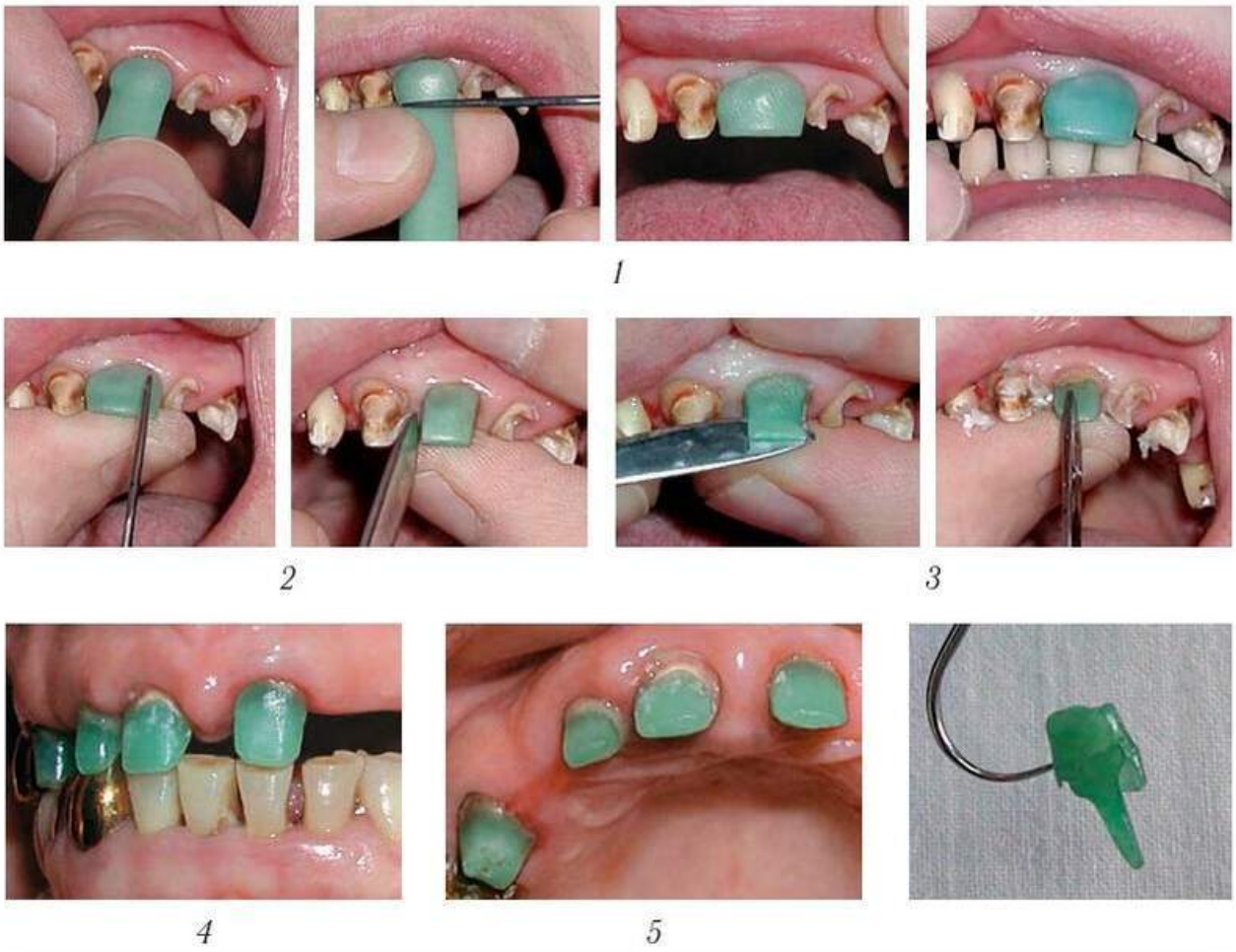

Fig. 171. **Stages of the stump inlay modeling** (explained in the text)

The wax composition is carefully returned into the root cavity and cut to the required length of the future tooth stump (Fig. 171, *1*). They simulate it with a sharp surgical scalpel. The use of individually made modeling tools is not excluded. Dentists often use the originally designed tools for the manufacture of inlays, as well as for the crowns restoration.

Then the crown part is simulated. While forming the stump, they model approximal surfaces (Fig. 171, *2*), then involve the palatal or lingual surfaces (Fig. 171, *3*), and complete the simulation stage on the vestibular surface. The control of occlusal relations is performed obligatory (Fig. 171, *4*). The requirements for the formation of the wax stump are the same as those for a natural tooth. It is important not to deform the wax composition during modeling and removal. Removal of the wax composition is performed with a thin dental probe (Fig. 171, *5*).

The modeled wax composition of the inlay is transferred to the casting laboratory. After casting the inlay, they process and fit it. The stage of its fixing is carried out in the clinic. Typically, one-piece stump inlays are fixed with zinc-phosphate or glass ionomer cements. The inlay is disinfected, degreased, and dried with a stream of air. The operating field is isolated applying cotton rolls; the system of saliva suction is