




**Pediatric Dental Prosthetics =
Дитяче зубне протезування:
підручник (ВНЗ IV р. а.)**

У підручнику розглянуті аспекти ортопедичного лікування у дітей: психоемоційний стан дитини в різні вікові періоди, психологічна підготовка до лікування, діагностика дефектів зубів і зубних рядів, показання і протипоказання до ортопедичного лікування, види протезів тощо. Окремий розділ присвячено травмам зубів і їх лікуванню.  Для студентів вищих медичних навчальних закладів IV рівня акредитації.  The fundamentals of orthodontics and children's prosthetics are outlined in the textbook as basic elements of modern pediatric dentistry. Urgency of the edition is caused by the fact that despite the pressing need for children's dental prosthetics, textbooks on this important field of stomatology are scarce. The textbook deals with various aspects of prosthetic treatment in children: the psychoemotional status of children in different age periods, psychological preparation for treatment, diagnosis of defects of teeth and dental arches, indications and contraindications for treatment, types of prostheses and their application in different periods of occlusion. A separate chapter is devoted to teeth traumas and their treatment.  For students of higher medical education institutions of the 4th level of accreditation.

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PEDIATRIC DENTAL PROSTHETICS

Edited by Professor P.S. FLIS

RECOMMENDED
by the Ministry of Education and Science,
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of higher medical education institutions
of the 4th level of accreditation

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CONTENTS

Preface	7
Chapter 1. Pediatric Dental Prosthetics.....	9
1.1. Clinical and Biological Grounds of Pediatric Dental Prosthetics	9
1.2. Causes of Teeth and Dental Arch Defects.	10
Self-Control Questions	18
Control Tests	18
Chapter 2. Psychoemotional Status of Children in Different Age Periods and Psychological Preparation for Treatment	21
2.1. Psychoemotional Status of Children in Different Age Periods	21
2.1.1. Behavior of Parents.....	23
2.2. Psychological Preparation of Children for Treatment	25
2.2.1. Development of Positive Attitude to Dental Treatment in Children.....	26
2.2.2. Influence of Dentist's Office Atmosphere.....	29
2.2.3. Methods of Psychological Preparation	30
2.2.4. Psychological Impact during Dental Treatment	32
Self-Control Questions	35
Control Tests	35
Chapter 3. Diagnostics of Teeth and Dental Arch Defects	38
3.1. Teeth Defects Diagnostics.....	38
3.1.1. Gnathodynamometric Studies	40
Self-Control Questions	44
Control Tests	44
3.2. Dental Arch Defects Diagnostics	46
3.2.1. Dental Arch Defects Classification.....	47
3.2.2. Anthropometric Measurements	50
3.2.3. X-Ray Examination in Orthodontics.....	53
3.3. Morphological and Functional Changes in Teeth and Dental Arch Defects	56

Self-Control Questions	59
Control Tests	60
Chapter 4. Indications and Contraindications for Pediatric Dentures	63
Self-Control Questions	65
Control Tests	65
Chapter 5. Prosthetics of Teeth Defects	68
5.1. Prosthetics of Teeth Defects in Temporary Occlusion	68
5.1.1. Fitting of Standard Metallic Crowns	73
5.1.2. Adjustment of Standard Metallic Crowns	75
5.1.3. Prosthetics Problems and Their Solution	82
5.1.4. Removable Celluloid Caps for Restoration of Temporary Incisors	83
5.1.5. Clinical-Laboratory Stages of Making Thin-Walled Metallic Crowns	89
5.1.5.1. Clinical-Laboratory Stages of Making Pin Crowns	90
5.2. Prosthetics of Teeth Defects in Transitional Dentition	91
5.2.1. Clinical-Laboratory Stages of Making Inlays	93
5.3. Prosthetics of Teeth Defects in Permanent Occlusion	96
Self-Control Questions	98
Control Tests	99
Chapter 6. Orthopedic Treatment for Dental Arch Defects	101
6.1. General Characteristics of Pediatric Dentures	101
6.2. Requirements to Removable Pediatric Dentures	110
6.2.1. Boundaries of Removable Denture Bases on the Upper Jaw	110
6.2.2. Removable Denture-Making Technique	112
6.3. Orthopedic Treatment for Dental Arch Defects in Temporary Occlusion	113
6.3.1. Orthopedic Treatment for Minor Dental Arch Defects in the Frontal Part	113
6.3.2. Orthopedic Treatment for Minor Bilateral Bounded Dental Arch Defects in the Lateral Part	114
6.3.3. Orthopedic Treatment for Minor Associated Dental Arch Defects	114

6.3.4. Orthopedic Treatment for Moderate and Major Dental Arch Defects	115
6.4. Orthopedic Treatment for Dental Arch Defects in Transitional Dentition	116
6.4.1. Orthopedic Treatment for Minor Unilateral Associated Dental Arch Defects in the Lateral Part	116
6.4.2. Orthopedic Treatment for Minor Bilateral Bounded Dental Arch Defects in the Lateral Part.....	117
6.4.3. Orthopedic Treatment for Moderate and Major Bounded Dental Arch Defects in the Lateral Part	117
6.4.4. Orthopedic Treatment for Minor Dental Arch Defects in the Frontal Part.....	118
6.4.5. Orthopedic Treatment for Moderate and Major Dental Arch Defects	119
6.5. Orthopedic Treatment for Dental Arch Defects in Permanent Occlusion	120
6.5.1. Orthopedic Treatment for Minor and Moderate Dental Arch Defects in the Frontal Part	120
6.5.2. Orthopedic Treatment for Minor and Moderate Dental Arch Defects in the Lateral Part.....	121
6.5.3. Orthopedic Treatment for Major Dental Arch Defects in the Lateral Part, Associated, not Limited Distally and Complicated by Dentognathic Deformities.....	122
Self-Control Questions	123
Control Tests	123
Chapter 7. Oral Cavity Preparation for Dental Prosthetics (Therapeutic, Surgical, Orthodontic)	126
7.1. Dentognathic Deformities Caused by Early Tooth Loss.....	126
7.2. Therapeutic Preparation of the Oral Cavity for Prosthetics	131
7.3. Orthodontic Preparation of the Oral Cavity for Prosthetics	131
7.3.1. Elimination of Vertical Occlusal Surface Deformities.....	132
7.3.2. Elimination of Mesiodistal Occlusal Surface Deformities	134
7.3.3. Elimination of Vestibulooral Occlusal Surface Deformities	137
7.4. Orthopedic Preparation of the Oral Cavity for Prosthetics	139
7.5. Surgical Preparation of the Oral Cavity for Prosthetics	140
7.6. Combined Preparation of the Oral Cavity for Prosthetics	141

Self-Control Questions	143
Control Tests	144
Chapter 8. Dental Traumas and Their Treatment	146
8.1. Etiology and Classification of Acute Dental Traumas	146
8.2. Peculiarities of Patient Examination after Acute Dental Trauma	153
8.3. Clinical Presentation and Treatment of Dental Contusion in Temporary, Transitional and Permanent Occlusion	157
8.4. Clinical Presentation and Treatment of Dental Dislocation in Temporary, Transitional and Permanent Occlusion.....	161
8.5. Clinical Presentation and Treatment of Dental Fracture Depending on Patient's Age, Trauma Type and Prescription	168
Self-Control Questions	170
Control Tests	170
References	173



PREFACE

Pediatric stomatology is one of the youngest areas of dentistry. In their research papers many dental scientists dwell on the development of dentognathic disorders in children.

Pediatric stomatology is quite a difficult specialty and includes pediatric restorative dentistry, all kinds of surgical treatment of the maxillofacial area in children, orthodontics and pediatric prosthetics.

The main problem concerns prevention of dentognathic anomalies and deformities because preventive measures are the most effective at early stages of masticatory apparatus development in children.

Pediatric prosthetics is part of routine oral cavity sanitation in children since early extraction of temporary teeth violates the integrity of dental arches. This leads to impairment of the masticatory function, development of dentognathic deformities, and also diseases of the digestive organs.

Defects of the teeth crowns and dental arches occupy a special place among dental diseases. This is connected with the characteristics of the children's organism which is actively developing. Unfortunately many professional dentists underrate the role of temporary teeth.

Children who have lost teeth for different reasons have long been considered not to need prosthetics. However, as early as 1937 Professor B.N. Bynin initiated prosthetics for children.

Pediatric prosthetic dentistry as part of general dentistry is certainly connected with adult prosthetic dentistry, though it is much younger. The independent development of this discipline in our country is associated with the name of Professor L.V. Ilyina-Markosian, who scientifically substantiated the necessity and expediency of pediatric prosthetics.

Despite the relevance of pediatric dental prosthetics there are virtually no textbooks on this important part of stomatology.

After L.V. Ilyina-Markosian, who in 1949 published the first textbook on pediatric prosthetics entitled *Dental Prosthetics in Children*, few scholars studied this important problem. Correspondingly, this discipline was not provided with enough textbooks, and those available contained a little information useful for doctors.

In 1972 there was published the textbook of A.I. Betelman, A.I. Pozniakova, A.D. Mukhina, and Y.M. Aleksandrova *Children's Prosthetic Dentistry*. The book contained 250 pages and only 25 of them concerned pediatric prosthetics.

The 75-page textbook of K.N. Shamsiyev *Dental Prosthetics in Children and Teenagers* (1985) again devoted only 25 pages to the problem of pediatric dental prosthetics.

T.V. Sharova and H.I. Rohozhnikova's textbook *Children's Prosthetic Dentistry*, published in 1991, provided more detailed information on pediatric prosthetics.

The fundamental work of Professor F.Y. Khoroshilkina *Orthodontics* was published in 2006. Still, out of its 540 pages only 11 were devoted to pediatric prosthetics.

There has been no such a book in Ukrainian.

Now who and where should get to grips with this problem?

Today we define **orthodontics** as a science studying the etiology, pathogenesis, clinical presentation, methods of diagnostics, treatment and prophylaxis of persistent anomalies and deformities of the dentognathic apparatus, and also **etiology, pathogenesis, clinical presentation, methods of diagnostics, treatment and prophylaxis of defects of the teeth, dental arches, jaws and face in children**.

Therefore the problems of pediatric prosthetics must be tackled by orthodontists, but all dentists are to possess certain knowledge and skills of this subject. Any ordinary person knows that at certain time a child is cutting temporary and later permanent teeth, though only doctors know the terms of teething, the time of the formation and resorption of the roots of temporary teeth and formation of the roots of permanent teeth. People appeal to orthodontists very late, because at first patients are treated by dental therapists, if necessary — by dental surgeons, but most persons do not even realize that untimely prosthetics in children may lead to severe consequences in maxillofacial area development.

We hope that the new textbook will help dentists and students of stomatological departments of higher medical educational establishments to master the knowledge of pediatric prosthetic dentistry.

Taking into account the existing gap in special literature on pediatric dental prosthetics, the authors will appreciate critical remarks.

*Professor
Flis Petro Semenovich*

DIAGNOSTICS OF TEETH AND DENTAL ARCH DEFECTS

3.1. TEETH DEFECTS DIAGNOSTICS

To diagnose defects of the dental crowns different classifications have been offered (Black, M.B. Bushan), which are mostly used in preventive dentistry. Y.V. Milikevych recommended defining the index of destruction of the occlusal surface of the tooth in the period of permanent occlusion. V.S. Kurylenko developed a classification which is closer to the prosthetics of dental defects in children, but it does not include the degree of tooth roots formation or resorption in children.

Clinical trials have shown that dental crown defects of different etiology in children are already found at early stages of dentognathic apparatus formation, i.e. still in the period of temporary occlusion, therefore they require urgent orthopedic treatment. When one chooses denture construction to restore a defect of the crown of a temporary (milk) tooth, one should find not only its cause but also the degree of destruction, the state of the root system (i.e. the degree of root formation or resorption), and also the ability of the tooth to withstand a functional load, i.e. one should conduct thorough differential diagnostics to make a final diagnosis. Such an approach is important in the diagnostic process in the period of both temporary and permanent occlusion, and especially in the period of transitional dentition, when temporary and permanent teeth with different conditions of the root system are found in the dental arch simultaneously. V.P. Vozniuk offered a classification of dental crown defects in children on the basis of epidemiological research and clinical observations (Diagram 3.1).

It takes into consideration the following diagnostic criteria: first of all temporary (I) or permanent (II) teeth are determined; then condition of the pulp: teeth with the vital pulp (1) or devitalized pulp (2); condition of the roots: without root resorption (A), with root resorption (B) — by 1/3 (a), by 2/3 (b), by 3/3 (c); with a formed root (C), with an unformed root (D): by 1/3 (a), by 2/3 (b). According to topography and localization (III): on the upper jaw (IIIA), on the lower jaw (IIIB), lateral teeth (1), frontal teeth (2). In its turn, one classifies the localization of the defect on the lateral teeth (1) on the masticatory surface (a),

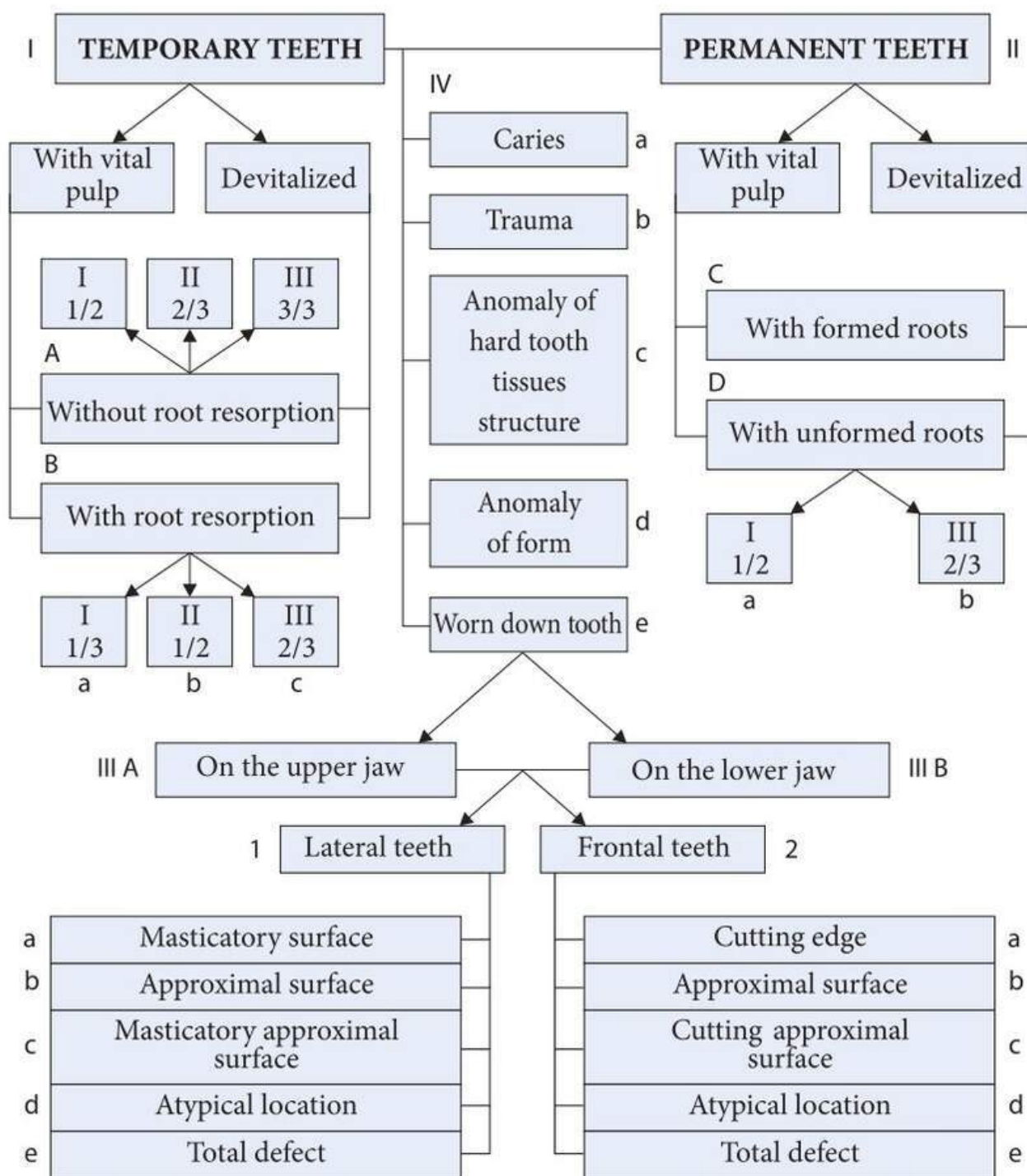


Diagram 3.1. Classification of tooth crown defects

approximal surface (b), masticatory approximal surface (c), atypical location (d), total defect (e); defects on the frontal teeth: cutting edge (a), approximal surface (b), cutting approximal surface (c), atypical location (d), total defect (e). According to etiology (IV): caries (a), trauma (b), anomaly of the structure of the hard tooth tissues (c), anomaly of the form (d), if the tooth is worn down (e).

The indicated classification broadly covers the main diagnostic criteria, which considerably facilitates differential diagnostics of dental crown defects in children and

helps the doctor not only in diagnostics but also in the choice of the most efficient denture construction.

To detect the functional adequacy of a tooth and its ability to withstand a certain functional load it is important for clinicians to have an idea not only of the condition of the tooth crown but also of the tooth root and not only of the hard tissues but also of the pulp. These diagnostic criteria are very important when it concerns the choice of treatment method and expedient denture construction, especially in children. Besides, functional capacity of some teeth depends on the form and size of their masticatory surface, anatomical integrity, number and height of tubercles, number and size of roots, degree of their formation and resorption, structure of the alveolar walls, condition of the parodontal tissues, location of the tooth in the dental arch and reactivity of the organism, especially of a child's one. During mastication the teeth render functional irritation to the periodontium, as a result there is created tension, which under normal conditions is adequate to the pressure force. Nevertheless, during mastication the force of masticating pressure is not used completely — only its part in the form of pressure during biting and mastication of food. Teeth of children of one and the same age have a certain physiological limit of endurance, which is unstable.

The methods of masticatory efficiency determination according to masticatory factors, where the pressure of the weakest tooth — the lateral upper incisor — is taken as a unit of measure, are somewhat empirical and meant for a certain age group of the examined, i.e. adults, whose dentognathic apparatus is already formed. Besides, they are based on static (stable) landmarks and interfere with the study of the process dynamics.

S.I. Tril and V.P. Vozniuk were the first in the practice of pediatric dental prosthetics to use gnathotensodynamometer to find the degree of functional disorders in children with teeth and dental arch defects. Investigation of masticatory endurance is based on the anatomico-functional age-related peculiarities of each tooth separately and the dentognathic apparatus in whole. The findings are of practical importance and may underlie indications for dental prosthetics.

Taking into consideration the fact that the children's dentognathic apparatus is still forming, the ability of the dental tissues and periodontium in whole to endure a certain load, especially vertically, should be considered an important and objective test determining the functional adequacy of teeth at a certain stage of functioning.

Thus, dental defects in children have certain peculiarities, which predetermines the need of weighed approach to differential diagnostics and choosing efficient constructions of dentures taking into account the age of the child, the degree and causes of tooth crown destruction, the condition of the root system, the number of damaged teeth.

3.1.1. GNATHODYNAMOMETRIC STUDIES

The success of orthopedic treatment both in children and adults with teeth and dental arch defects depends on correct selection of supporting elements and choice of efficient denture construction, which is impossible without objective appraisal of

the functional status of the masticatory apparatus. Scientists have offered a number of techniques to solve this problem, notably:

- determination of the degree of food grinding in the process of mastication by means of masticatory tests;
- examination of the masticatory muscles: the type of reflex masticatory movements of the lower jaw by means of masticatiography;
- determination of the muscles tone and electrical activity;
- determination of the functional endurance of physical (masticatory) load by the periodontal tissues, which is described as functional strength of the periodontium in literature.

Endurance of the periodontium is assessed by different methods, which are based on the classical technique of gnathodynamometry. For this scholars used Black's, Tissenbaum's, Haber's gnathodynamometers, electronic gnathodynamometer (I.S. Rubinov, L.M. Perzashkevych), electronic parodontometer, tensodynamometer.

Each of the mentioned techniques of investigating the condition of the masticatory apparatus has its advantages and disadvantages. Such techniques as masticatory tests, masticatiography, electromyography, myotonometry are mostly used for scientific purposes, because they require special equipment and considerable expenditure of time, and also appropriate knowledge and skills. Therefore in practice orthopedic dentists prefer statistical methods, which allow estimating and determining the masticatory efficiency of the dentognathic apparatus according to masticatory factors, notably according to Ahapov and Oksman. Nevertheless, to our mind it is inexpedient to use the factors determined by these authors in pediatric prosthetics because the children's masticatory apparatus is still developing, roots of temporary teeth are being formed and resorbed, roots of permanent teeth are being formed, the height of occlusion is being established, the jaw bones are growing, etc. At the same time this information is important for the doctor. Special literature gives information on the masticatory value of teeth in children considering their morphological and functional peculiarities, therefore this information will make it possible for specialists to objectively assess functional capabilities of both separate teeth and the whole masticatory apparatus, and on its basis choose an efficient denture construction (a single crown, a dental bridge or a removable denture).

Practical activity of a dentist consists in prevention, treatment and prosthetics of dental defects. Therefore mathematical apparatus is an adequate instrument, which sufficiently describes such an activity as mathematical statistics that studies quantitative regularities of mass phenomena inseparably linked with their qualitative aspect under concrete conditions of time and place.

CRITICAL AND CONSTRUCTIVE ANALYSIS OF THE BASIC NOTION OF THE SUBJECT OF INVESTIGATION. INTRODUCTION OF THE NEW SYNTHETIC NOTION OF VPD

The subject of our investigation is the maximum static force of the tooth, whose numerical value is fixed when pain appears in the periodontium of temporary and permanent teeth in health and disease.

The notion of force belongs to the branch of science mechanics, which classifies the origin of force into three types:

1. **Static force** is constant force, which acts over a long period of time.
2. **Dynamic force** increases instantly and acts during a short period of time, i.e. has the nature of a blow.
3. **Recurrent forces** repeat many times. They are used during cyclic endurance or fatigue tests.

Endurance of materials is the ability of materials and constructions to resist the action of repeated (cyclic) loads.

Load is all the forces acting on a body (structure, mechanism, machine component, etc.).

And it is the notion “endurance” which characterizes “resistance to the action of repeated (cyclic) loads”, that describes the maximum static force of a tooth, whose numerical value is registered when pain appears in the periodontium. This is an explicit contradiction, which needs to be solved.

Notion is a general idea that corresponds to some class of entities and that consists of the characteristic or essential features of the class.

Important features of this investigated specific force include:

- its static origin;
- pain induction in a patient with simultaneous registration of the numerical value of its maximum.

Further constructive analysis of the subject of investigation brings us to a conclusion that the traditional notion “endurance”, firstly, inconsistently imposes a non-existent cyclic property on the phenomenon of static origin, and secondly, does not indicate the moment when force induces pain. That is, at present there is no notion defining this phenomenon.

Therefore an objectively necessary notion should simultaneously denote both the physical, and specifically mechanical notion of the phenomenon — **force**, and the consequence predetermined by it — **pain induction**.

Taking into account the arguments mentioned above, the complete name of the new notion must have the following form: “**the maximum static force of pain induction**”. A shortened form: “**force of pain induction**”.

It would be logical to use the Latin language, scientifically accepted as a means of forming new notions, to form a one-word Latin abbreviation of the force of pain induction:

force — vis;

induce — provoco;

pain — dolor.

Thus, we have a new one-word notion:

VisProDol (VPD; V).

Thereby, the meaning of the new notion is **force of pain induction**, the sign — VPD, or V.

The symbol “V” may be used with indices specifying the content of this value in each case, for instance:

V_{\max} — the maximum force of pain induction;

V_{\min} — the minimum force of pain induction;

V_m or m — mathematical expectation.

To find the degree of functional disorders in children with teeth and dental arch defects scholars studied the force of periodontal pain induction to the vertical load of temporary teeth in the process of their formation and root resorption, and also of permanent teeth in the period of their normal functional formation. Periodontal pain induction under nonrecurrent static vertical load is studied with the help of the gnathotensodynamometer, which consists of a measuring tension girder with two steel branches located parallel to one another with a certain gap and tightly joined.

The ends of the steel branches end with a bite plate — on one of them, and a bite shield — on the other one. Two tension sensors assembled into a tension circuit are glued to each branch. To facilitate biting the plates are covered with removable food rubber (Fig. 3.1).

When force is applied to the tension girder, mechanical deformation takes place and causes linear varying of the current in the resistive-strain sensors glued to the girder, i.e. transformation of mechanical deformation of the girder in direct proportion to the change of current in the measuring circuit of the resistive-strain sensors. Since the received signal is weak (0—20 mV), it should be intensified. Converter amplifier (ID-1) intensifies the circuit signal, which is received by the computer, to 2 V. Besides, the device has a digital scale, which allows visually observing the obtained efforts measured in kilograms (kg). The value of intensification is registered on the chart strip in kilograms and time.

Computer allows registering, storing, decoding and putting out information in the form of schedules and results of calculation. A branch of the tensodynamometer is fixed with a semicircular bite shield on one of the patient’s jaws opposite to the examined tooth, and the other branch with an operating bite plate is brought to its occlusal surface, the patient is asked to clench his teeth until he feels mild pain in the examined tooth. Then other teeth are examined by moving the branches. Measurements are conducted from right to left first on the upper jaw and then on the lower one. The findings are registered with the help of an electronic digital recording device. Then the doctor studies electronic odontograms, evaluates the



*Fig. 3.1. Tensognathodynamometer
(general view)*

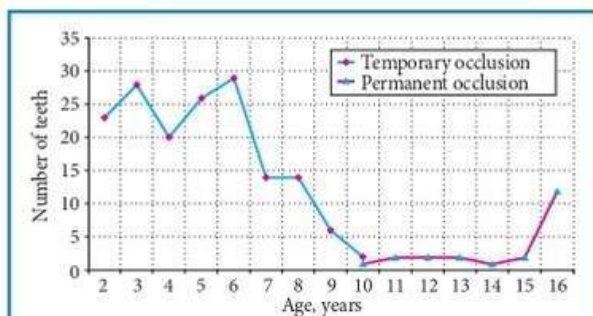


Fig. 3.2. Occurrence of complete destruction of the dental crown in different age periods

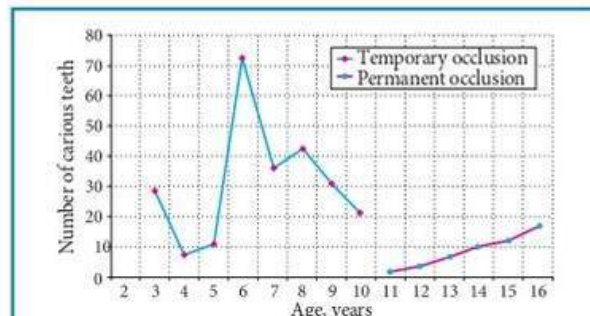


Fig. 3.3. Occurrence of dental caries in different age periods

functional state of the periodontium by comparing the obtained results with the normal indices, i.e. the data obtained in children of the same age with intact teeth and dental arches.

Standard data of electrognathodynamometry have been established on the basis of measuring periodontium endurance in healthy children with intact teeth and dental arches and physiological occlusion at the age of 3—17 years, which allows finding the normal indices in different age periods (Fig. 3.2—3.4).

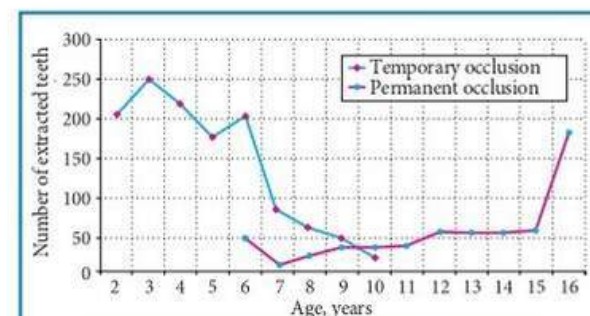


Fig. 3.4. Number of prematurely extracted teeth in different age periods

SELF-CONTROL QUESTIONS

1. Name classifications of dental crown defects in children.
2. What is the “total defect” of a tooth?
3. V.S. Kurylenko’s classification.
4. Black’s classification.
5. Name mechanical gnathodynamometers.
6. Name electronic gnathodynamometers.
7. What is the force of pain induction?
8. What is material endurance?
9. What is static force?
10. What is dynamic force?

CONTROL TESTS

1. Which technique determines the force of pain induction in the periodontal tissues?

MEDLIT
медична література

КУПИТИ