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Distinctive Features of Orthodontic and Orthopedic Methods of Treatment of Deep Dental Filling Disorders

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Relevance. Dental diseases often lead to tooth loss. According to WHO, the prevalence of tooth loss among the world's population reaches 75%. The number of teeth removed due to caries complications worldwide increased significantly between 2006 and 2016, with Russia taking the leading position. A defect in the dentition entails a violation of the adaptive and compensatory reserve of the maxillary apparatus and forms pathologies such as increased tooth erasure, inflammatory and dystrophic changes in periodontal tissues, secondary deformation of the position of the teeth that limit the defect of the dentition, occlusive and musculoskeletal dysfunction. The problem of replacing dental defects, despite the high level of dental science and the development of digital technologies, is still relevant and significant. Currently, dental row defects are replaced mainly by bridge-like structures - therapeutic and prophylactic prostheses with complete artificial crowns, which, as a rule, involves the need for depulpation of the supporting teeth due to their inclination towards the defect. Endodontic treatment is associated with a high risk of complications, which significantly shortens the life of the supporting teeth, and, consequently, the operational life of the bridge-shaped therapeutic and preventive prosthesis. For the long-term operation of therapeutic and prophylactic prostheses that replace small defects in the lateral sections of the dentition, it is necessary to prepare the hard tissues of the supporting teeth as gently as possible. Adhesive bridges that meet the requirements of minimal invasion have a high risk of cementation and breakage. Digital technologies make it possible to create non-removable structures of high-quality prostheses. The development of an effective, affordable and scientifically based method of replacing a dental defect with bridge-like structures with improved fixation that meets the requirements of minimal invasion and allows extending the service life of supporting teeth is an urgent task of modern dentistry that requires detailed study, which determined the purpose and objectives of this study. To develop the design of a three-element bridge-like prosthesis with modifications to replace defects in the lateral sections of the dentition of short length with convergence of the supporting teeth and to analyze the stress-strain state of the biomechanical model of this design in a mathematical experiment. To compare experimentally, under cyclic loads, the physico-mechanical "behavior" and the stability of the mechanical characteristics of model polymer fixed structures of dentures manufactured using traditional, digital subtractive and additive technologies. To develop a method for X-ray evaluation of the anatomical and topographic boundaries of the dental pulp cavity to form a personalized protocol for their preparation and to determine the structural features of short-length bridges. For the first time, the reliability of the boundaries of the pulp cavities on radiographs and in native teeth has been studied in a comparative aspect in order to safely prepare teeth tilted towards the dentition defect under the support of a three-element bridge prosthesis. For the first time, the effect of dynamic loading modes on the stress-strain state of a short-length prosthesis was studied and it was shown that the tooth pulp is a natural vibration dampener, as a result of which it is necessary to maintain the vitality of the supporting teeth to increase their service life. The relationship between the stress-strain state of the periodontal supporting teeth, which limit the defects of the lateral sections of the dentition of short length, and the structures of the traditional and developed bridge prosthesis is revealed and analyzed.

A method of X-ray assessment of the anatomical and topographic boundaries of the tooth cavity has been developed, which makes it possible to plan and implement a protocol for safe dental preparation, predict the parameters of the stump of the supporting teeth and the design features of a

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short-length bridge prosthesis. Based on the results of mathematical modeling, a method for calculating the design of a three-element bridge prosthesis and the tissues surrounding the supporting teeth is proposed. The use of the developed protocol for dental orthopedic treatment of patients with short-range defects in the lateral sections of the dentition and secondary deformation of the supporting teeth, including scientifically based analysis, mathematical calculations and updated data from mechanical tests of structural materials, allows to personalize the three-element bridge structure, shorten the period of adaptation to the polymer therapeutic and preventive prototype prosthesis and increase the service life of the final zirconium dioxide prosthesis, created by the method of subtractive computer milling. Calculations of the stress-strain state of a three-element bridge prosthesis, its modifications and surrounding tissues, taking into account occlusal loads and pronounced convergence of the supporting teeth, make it possible to reconstruct occlusion in patients with short-range dental defects and secondary deformity of the supporting teeth using orthopedic construction and thereby normalize the function of the dental apparatus. The clinical and technological algorithm for the integrated use of the mathematical model and the proposed tool for simulating the geometry of the prosthesis, the choice of structural material, as well as the proposed method for X-ray evaluation of the anatomical and topographic boundaries of the tooth cavity allow predicting success and implementing effective dental orthopedic treatment with a high degree of reliability. The author's personal contribution consists in the development and independent modeling of a digital three-dimensional universal tooling design for studying the strength characteristics of bridge structures on a universal testing machine, manufacturing samples and testing them, analyzing data and processing them statistically. He independently examined 582 patients. Based on the formulated inclusion, non-inclusion, and exclusion criteria, 63 patients with short-range dental defects were treated with ultrasound Dopplerography, periotestometry, digital occlusography, and prosthetics using developed bridges. The results obtained during the research and new scientific data were analyzed, systematized and statistically processed by the author under the guidance of a scientific supervisor. An abstract and a dissertation have been prepared.

Conclusion. The treatment of patients with disorders and diseases of the dental apparatus consists in the restoration and reconstruction of not only the morphology, but also, first of all, its function. In the partial absence of teeth, the condition of the occlusal surface of the dentition is important, which must be in harmony with the musculoskeletal complex and articulation of the lower jaw. The functional integrity of the dental apparatus is the usefulness of chewing, speech, and facial aesthetics. The success of dental rehabilitation of such patients depends on the correctness of the medical strategy, tactics and techniques of prosthetics, personalized design of denture structures, the use of modern innovative digital technologies and structural materials.

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