INNOVATIVE APPROACHES TO SPACE MAINTENANCE IN CHILDREN AFTER PREMATURE LOSS OF PERMANENT MOLARS

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Relevance of the Problem. The early loss of permanent molars in children represents a pressing issue in pediatric dentistry and orthodontics, often leading to significant disruptions in occlusal development, the eruption sequence of permanent teeth, and harmonious craniofacial growth. Without timely intervention, such conditions may result in tooth migration, space deficiency, midline deviation, and functional disorders involving the masticatory system. In this regard, preventive prosthetic interventions serve as a cornerstone of early rehabilitation strategies aimed at preserving the integrity of the dental arch and preventing the progression of dentoalveolar and skeletal anomalies.

Limitations of Conventional Preventive Prostheses. Despite their recognized importance, traditional designs of preventive prostheses and space maintainers used in pediatric practice exhibit several notable limitations. Chief among them are insufficient adaptability to the anatomical and physiological conditions of the growing maxillofacial system, a lack of modularity and adjustability, limited personalization, as well as concerns related to long-term biocompatibility and ease of hygiene maintenance. Furthermore, the psychological discomfort and poor aesthetics associated with outdated prosthetic devices often result in reduced compliance among children and their caregivers, thereby undermining treatment efficacy.

Proposed Innovations and Technical Improvements. In light of the identified shortcomings, this research proposes an optimized model of preventive prosthesis for pediatric use. Key innovations include the utilization of flexible, hypoallergenic, and biocompatible materials that minimize mucosal trauma and enhance comfort; the incorporation of adjustable components to accommodate ongoing craniofacial development; and the integration of digital design technologies (CAD/CAM) to enable precision manufacturing and patient-specific customization. Special emphasis is placed on improving prosthetic designs to facilitate effective oral hygiene, reduce plaque accumulation, and lower the incidence of soft tissue inflammation. The use of 3D scanning and printing further streamlines the clinical workflow and enhances accuracy.

Preliminary Clinical Outcomes. Preliminary clinical trials involving pediatric patients who received the improved preventive prosthesis demonstrated a range of positive outcomes. These include higher patient and parental satisfaction scores, better compliance with prosthetic use, improved oral hygiene indicators, and a statistically significant reduction in space loss and midline shift compared to the control group using

conventional appliances. Moreover, no adverse tissue reactions or mechanical failures were observed during the follow-up period, further underscoring the clinical feasibility of the proposed approach.

Conclusion and Future Directions. The development and clinical implementation of enhanced preventive prosthetic devices for children following the early loss of permanent molars mark a significant advancement in pediatric dental care. The combination of innovative materials, digital design technologies, and a patient-centered approach holds considerable promise for improving both functional and aesthetic outcomes. Future research should focus on long-term follow-up, comparative effectiveness studies, and broader integration of such prostheses into interdisciplinary pediatric rehabilitation protocols.