



Prevention Methods of Tooth-Jaw Deformities in Children with Uranoplasty

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Abstract. Cleft lip and palate is one of the most common congenital malformations of the maxillofacial region and causes not only aesthetic but also functional disorders of speech, swallowing and mastication. Uranoplasty eliminates the communication between the oral and nasal cavities, but the scar tissue formed after surgery can restrict the growth of the upper jaw and lead to dentoalveolar deformities. The aim of this study was to summarize current evidence on the influence of palatoplasty protocols on the development of the dental arches, on the frequency of dental and occlusal anomalies in children with cleft lip and palate, and to substantiate methods for preventing tooth-jaw deformities after uranoplasty. A narrative review of 17 publications from 1986 to 2025 was carried out, covering clinical studies with digitized dental models, cephalometric and epidemiological studies, systematic reviews and classic works on orthodontic treatment and alveolar bone grafting. The analysis showed that both one-stage and two-stage palatoplasty reduce the anterior dimensions of the maxillary arch compared with children without clefts, while two-stage palatoplasty is associated with a more favorable prognosis for maxillary growth. Malocclusion, crowding, hypodontia and microdontia of the lateral incisors are common, and an unfavorable sagittal intermaxillary relationship is significantly associated with reduced oral-health-related quality of life in adolescents. Secondary alveolar bone grafting is most effective when one-half to two-thirds of the root of the permanent canine has formed. Prevention of tooth-jaw deformities therefore requires a growth-friendly surgical protocol, regular orthodontic monitoring from early childhood, timely orthodontic and orthopedic treatment, and alveolar bone grafting within a multidisciplinary team.

Keywords: Cleft lip and palate; uranoplasty; palatoplasty; maxillary growth; dental arch; malocclusion; alveolar bone grafting; orthodontic prevention.

1. Introduction

Cleft lip and palate is one of the most common developmental defects of the facial skeleton. It causes not only aesthetic but also functional disorders, and changes in the dental system occur much more often in these children than in the healthy population. Anatomical defects that arise during embryonic development disrupt the normal fusion of the upper jaw segments; as a result, the anatomical structure of the upper jaw changes and the configuration of the alveolar arch is disturbed [1].

Uranoplasty is one of the main surgical treatments for congenital palatal defects. It eliminates the pathological connection between the oral and nasal cavities and creates the necessary conditions for the normal development of speech and swallowing. However, morphological and functional changes may occur in the development of the facial skeleton after surgery, and the growth of the upper jaw often slows down. One of the main reasons is the scar tissue formed after surgery, which limits forward and lateral growth of the maxilla; the effect of relaxing incisions on long-term maxillofacial growth has been confirmed by cephalometric follow-up [2]. The timing of palatoplasty is also discussed as a factor affecting maxillary growth [3], and the orthodontic



experience of the past decades shows that treatment of these patients must be staged and adapted to the age and development of the dentition [4].

The choice of surgical protocol and the timing of orthodontic and orthopedic interventions are therefore key factors in preventing tooth-jaw deformities. The aim of this study was to summarize the evidence on the influence of palatoplasty protocols on dental arch development, on the frequency of dental and occlusal anomalies and their effect on quality of life, and on this basis to substantiate methods for preventing tooth-jaw deformities in children after uranoplasty.

2. Materials and Methods

The study was designed as a narrative literature review. Publications were searched in PubMed, Scopus and Google Scholar using the keywords “cleft lip and palate”, “palatoplasty”, “uranoplasty”, “one-stage and two-stage palatoplasty”, “dental arch”, “maxillary growth”, “malocclusion”, “oral-health-related quality of life”, “infant orthopedics” and “alveolar bone grafting”.

Clinical studies, systematic reviews and classic methodological works were included if they addressed at least one of three questions: (i) the effect of surgical protocols on dental arch dimensions and maxillary growth; (ii) the frequency of dental anomalies and malocclusion and their effect on quality of life; and (iii) orthodontic, orthopedic and surgical methods for preventing and correcting tooth-jaw deformities. Seventeen publications from 1986 to 2025 were selected.

For each publication, the study design, sample size, age of patients, surgical protocol, measurement method (digitized dental models, cephalometry, clinical examination, questionnaires) and main outcomes were extracted. The data were then grouped thematically, and a staged scheme of preventive measures was compiled on the basis of the synthesized evidence.

3. Results and Discussion

3.1. Effect of surgical protocols on the development of the dental arches

Digital technologies make it possible to evaluate the dental arches of children with clefts objectively and over long periods. In the digital workflow used at a specialized craniofacial rehabilitation hospital, maxillary impressions are taken before lip repair (3 months), after lip repair but before palate repair (12 months), after palate repair (24 months) and in the deciduous dentition (from 5 years); the casts are digitized with a 3D scanner, and intercanine and intertuberosity distances, palatal lengths, palatal area and volume are measured with special software [5]. Using this approach, 168 digitized dental models of children with unilateral cleft lip and palate were studied in two groups: in the first group, cheiloplasty was followed by one-stage palatoplasty, and in the second group the palate was closed in two stages, first the hard palate and then the soft palate. In both groups, the width of the dental arch and the configuration of the palatal segments changed after surgery; in the one-stage group the cleft width decreased before palatoplasty, while the length and depth of the palatal segments increased mainly after surgery, and in the two-stage group the growth of the palate was relatively better.

These findings agree with the results of comparative studies of the two protocols. In 5-year-old children, the intercanine distance and the anterior and total arch lengths were smaller after both one-stage and two-stage palatoplasty than in children without clefts, and occlusion assessed by the Attack index was worse, although the two protocols did not differ from each other [6]. At the 6-year follow-up of 56 digitized casts, however, the anterior arch length was significantly smaller after one-stage palatoplasty, and the authors concluded that two-stage palatoplasty showed a more favorable prognosis for maxillary growth [7]. The width of the cleft is also related to the symmetry of the dental arch [8].

Transverse deficiency of the maxilla is one of the most typical consequences of uranoplasty. Changes in the transverse dimension of the maxillary arch are already evident in 5-year-old children with unilateral cleft lip and palate [9], and the transverse relationship of the dental arches has characteristic features in these patients [10]. The relationship of the dental arches and the morphology of the palate after surgical treatment depend on the protocol used [11]. Taken together,



these data indicate that surgical protocols that reduce early scarring of the hard palate are more favorable for the physiological development of the upper jaw.

3.2. Dental anomalies and malocclusion

Dental anomalies in children with cleft lip and palate are associated with the incorrect formation of facial structures during embryonic development. The frequency of hypodontia increases with the severity of the defect. Changes in the shape and size of the teeth are also common: lateral incisors are most often microdont or conical, enamel hypoplasia is sometimes observed, and macrodontia or taurodontism occur in some cases.

In an observational cross-sectional study of 80 patients older than 8 years, divided into cleft lip, unilateral cleft lip and palate, and bilateral cleft lip and palate groups, malocclusion was assessed by the Angle classification using the relationship of the upper and lower first molars. Class I was the most common (46.3%), followed by Class III (35%) and Class II (17.5%); crowding of the upper anterior teeth was found in 72.5% of patients and crowding of the lower anterior teeth in 53.7%. The distribution of Angle classes varies considerably between populations and cleft types: in a study of 168 patients in India, Class II and Class III malocclusions were found in 10.7% and 4.9% of patients, respectively, and were most frequent in unilateral cleft lip [12]. Cephalometric studies also show specific craniofacial morphology even in adolescents with an isolated cleft palate [13]. These results reflect a skeletal and alveolar discrepancy caused by insufficient alveolar growth.

3.3. Effect of tooth-jaw deformities on quality of life

Tooth-jaw deformities affect not only clinical indicators but also the everyday life of patients. In 122 Norwegian 16-year-olds with clefts, patients with unilateral and bilateral cleft lip and palate had poorer clinical indicators than those with cleft lip or cleft palate alone. Eighty percent of the patients reported some impact of oral health on their quality of life (OHIP-14 score above zero), mainly in the psychological and articulation domains. Only an unfavorable sagittal intermaxillary relationship (ANB angle below 0°) was significantly associated with poor quality of life, whereas missing and misaligned teeth showed negative but non-significant associations [14]. Prevention of sagittal and transverse discrepancies between the jaws is therefore the most important goal of treatment.

3.4. Orthodontic and surgical methods of prevention

Early orthodontic treatment reduces the distance between the upper jaw segments, partially restores the shape of the alveolar arch, facilitates subsequent surgical treatment and reduces the negative effects of the oronasal communication [1]. Presurgical orthopedics has long been used in the surgical management of unilateral cleft lip and palate [15]; however, a randomized study showed that infant orthopedics has no effect on maxillary arch dimensions in the deciduous dentition [16]. Its use should therefore be justified by specific clinical goals rather than by the expectation of improved maxillary growth.

Secondary alveolar bone grafting is a key stage of rehabilitation. The optimal time for grafting is when one-half to two-thirds of the root of the permanent canine has formed [17]. Orthodontic preparation before grafting (expansion of the maxillary arch and alignment of the teeth) improves surgical access to the defect, bone formation and the continuity of the alveolar arch, and creates conditions for the eruption of the canine through the grafted bone. After grafting, orthodontic treatment normalizes the position of the teeth, improves the intermaxillary relationship and the aesthetic result [4]. Late bone grafting can also give a positive result in some cases, but treatment in the optimal period is more effective.

3.5. Staged scheme of prevention

On the basis of the reviewed evidence, the main preventive measures can be arranged by stages of the child's development (Table 1).



Table 1. Staged scheme for preventing tooth-jaw deformities in children with uranoplasty

Age / stage	Preventive measure	Purpose
3 months	Cheiloplasty; baseline digital dental model [5]	Starting point for monitoring arch development
First year of life	Presurgical orthopedics only for specific indications [16]	Facilitate surgery; no proven effect on arch dimensions
3–12 months	Palatoplasty with a protocol that limits early hard-palate scarring (e.g., two-stage) [7]	Reduce restriction of maxillary growth
2–6 years	Regular orthodontic examination with digital models; early correction of transverse deficiency [9]	Detect and correct arch narrowing early
Mixed dentition ($\frac{1}{2}$ – $\frac{2}{3}$ of canine root formed)	Pre-graft orthodontics and secondary alveolar bone grafting [17]	Restore alveolar continuity and canine eruption
Permanent dentition, adolescence	Comprehensive orthodontic treatment; assessment of sagittal relation and quality of life [14]	Correct intermaxillary discrepancy and improve quality of life

The scheme emphasizes that prevention starts with the choice of surgical protocol and continues through regular monitoring until the end of growth. Treatment requires a multidisciplinary approach involving an orthodontist, a maxillofacial surgeon, a speech therapist and other specialists.

4. Conclusion

Tooth-jaw anomalies occur in almost all children with cleft lip and palate and cause both functional and aesthetic problems. Scar tissue formed after uranoplasty limits the forward and lateral growth of the upper jaw; both one-stage and two-stage palatoplasty reduce the anterior dimensions of the maxillary arch, but two-stage palatoplasty is associated with a more favorable prognosis for maxillary growth. An unfavorable sagittal intermaxillary relationship is the deformity most strongly associated with reduced quality of life in adolescents.

Prevention of tooth-jaw deformities in children with uranoplasty should include: the choice of a growth-friendly surgical protocol; regular orthodontic examinations with digital dental models from early childhood; early correction of transverse and sagittal discrepancies; and secondary alveolar bone grafting when one-half to two-thirds of the canine root has formed, with orthodontic treatment before and after grafting. Such a staged, multidisciplinary approach makes it possible to coordinate the growth of the jaws and reduce the development of dental arch deformities.

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