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THE STATE OF DENTAL ARCH SUPPORTING ZONES IN CHILDREN IN VOJVODINA

STANJE POTPORNIH ZONA ZUBNIH LUKOVA KOD DECE U VOJVODINI

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Abstract
Introduction. The supporting zone is an orthodontic term that defines the space from the distoproximal surface of the lateral permanent incisor to the mesial surface of the first permanent molar. The aim of this study was to determine the space available within the supporting zones to accommodate the permanent successor teeth in children from Vojvodina aged nine, ten and eleven years, and to assess whether the conditions for the second phase of tooth replacement were present. **Material and Methods.** Study models from patients of the Department of Orthodontics, Clinic of Dental Medicine of Vojvodina, were used. A total of 42 models from patients aged nine, ten and eleven years, with equal representation of both sexes, were analysed. Using Onyx CephTM software and the Moyers analysis, the required space within the supporting zones. The resulting values were compared according to sex, age and jaw quadrant. **Results**. The supporting zone showed sufficient space in 64.3% of cases in the maxilla, and in 54.8% in the mandible. In the remaining 35.7% of maxillary cases and 45.2% of mandibular cases, a lack of space was observed. No statistically significant difference (at a level of 0.05) was found according to sex, age or side of the jaw, whereas a significant difference was found between the maxilla and the mandible. **Conclusion**. The condition of the supporting zones in children in Vojvodina is satisfactory, as are the level and trend of continuous dental care.
Key words: Dental Arch; Child; Dentition, Mixed; Malocclusion; Orthodontics; Dental Care

Sažetak
Uvod. Potporna zona predstavlja prostor ključan za smeštaj stalnih zuba tokom druge faze smene, a njen integritet zavisi od očuvanosti mlečne denticije i rezervnog prostora (engl. *leeway space*). Cilj rada bio je da se ispita raspoloživi prostor u potpornim zonama kod dece uzrasta 9–11 godina u Vojvodini i proceniti uslove za pravilno nicanje stalnih zuba. **Materijal i metode.** Analizirana su 42 studijska modela dece oba pola (9, 10 i 11 godina) sa Klinike za stomatologiju Vojvodine. Mojersovom analizom, uz pomoć programa *Onyx CephTM*, određeni su potreban i raspoloživ prostor u potpornim zonama. Rezultati su poređani prema polu, uzrastu i kvadrantu vilica, uz primenu t-testa. **Rezultati.** Dovoljan prostor u maksili utvrđen je u 64,3%, a u mandibuli u 54,8% slučajeva. Nedostatak prostora zabeležen je u 35,7% u maksili i 45,2% u mandibuli. Nije utvrđena statistički značajna razlika u odnosu na pol, uzrast i stranu vilice ($p > 0,05$), dok razlika između maksile i mandibule jeste značajna. **Zaključak.** Stanje potpornih zona kod dece u Vojvodini je zadovoljavajuće, ali se češće uočava nedostatak prostora u mandibuli, što ukazuje na značaj rane dijagnostike i preventivnih mera.
Ključne reči: zubni luk; dete; mešovita denticija; malokluzija; ortodoncija; stomatološka zdravstvena zaštita

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Introduction

The supporting zone is an orthodontic term that defines the space from the distoproximal surface of the lateral permanent incisor to the mesioproximal surface of the first permanent molar. During the deciduous and mixed dentition periods, this space consists of the deciduous canine, first and second deciduous molars, and diastemas [1]. The most stable diastemas are located between the lateral incisor and canine in the maxilla and between the canine and first molar in the mandible. These diastemas are referred to as primate or anthropoid spaces [2].

The width of deciduous molars together with canines and diastemas is greater than the width of their permanent successors, and this additional space is referred to as the leeway space. The leeway space amounts to 1.5 mm in the maxilla and 2.5 mm in the

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mandible. Its importance lies in accommodating the permanent canine and the first and second premolars, and in permitting the mesial movement of the lower molars to achieve Angle Class I molar relationship and proper intercuspation (the mesial shift) [1,2]. An exception occurs in subjects with Class III malocclusion, in whom the summed crown width of the mandibular incisors exceeds the average value in the general population [3].

Deciduous teeth form a functional unit that serves multiple roles until they are replaced by permanent teeth. They participate in all orofacial functions (breathing, swallowing, mastication, and speech), enable normal jaw growth and development, preserve space for successors, and contribute to facial aesthetics [4,5].

Premature tooth loss or reduced tooth width due to untreated approximal caries can disturb this balance, leading to reduction of the supporting zone, loss of arch length, and development of malocclusions [2,6,7]. Premature tooth loss is defined as loss of a deciduous tooth without eruption of its successor within six months, or when the root of the permanent successor has not developed at least two-thirds, as seen on radiographs [4,8].

Caries and its complications remain the most common aetiological factor of premature tooth loss. Dental trauma, most frequent between ages seven and ten, is another important factor [2].

The rate and extent of space loss depend on the patient's age, the lost tooth, and the available space in the arch. A longer time interval between tooth loss and expected exfoliation leads to greater space loss [2]. The greatest and fastest space loss occurs after extraction of the second deciduous molar, especially in the mandible, and the maxillary canine due to their late replacement. Individuals with primary crowding experience more rapid space loss, while those with spaced dentition usually do not develop crowding or malocclusion [4].

To determine whether the available space is sufficient for permanent canines and premolars, Moyers analysis is used [5]. By summing the mesiodistal widths of the lower four permanent incisors and using Moyers tables, the predicted sizes of teeth in the supporting zone can be determined and compared with arch length. The results may indicate excess space, normal conditions, or lack of space [7,10,12]. Clinically, identifying space deficiency is most important, as it leads to secondary crowding and functional and hygienic complications [13,14].

The aim of this study was to determine the available space in the supporting zones for the accommodation of permanent successor teeth in children from Vojvodina aged nine, ten, and eleven years, and to evaluate differences differences by sex, age, and jaw quadrant.

Material and Methods

The study was conducted in January 2025 at the Clinic of Dental Medicine of Vojvodina, Faculty of Medicine, University of Novi Sad, with approval from the Ethics Committee. It was designed as a cross-sectional study using study models from the Department of Orthodontics.

A total of 42 patient models were analysed (14 per age group), with equal numbers of males and females (21 each), born between 1 January 2006 and 31 December 2009.

Using Onyx CephTM software, the mesiodistal widths of the lower permanent incisors were measured and summed. The boundaries of the supporting zone were defined as the most prominent distal point of the lateral incisor and the mesial point of the first permanent molar.

Moyers' analysis was used to calculate the required, available, and difference spaces for each patient. Results were compared by sex, age, and jaw quadrant. Statistical analysis was performed using the t-test, with results presented in **Tables 1–5.**

Table 1. Dental development stages

0	Tooth germ with no signs of calcification
A	Calcification of individual parts of the occlusal surface, but without fusion
B	Fusion of parts of the occlusal surface; the contour of the occlusal surface is recognisable
C	Crown calcification is complete; dentine deposition begins
D	Tooth crown fully formed up to the cementoenamel junction
E	Root length shorter than crown height
F	Root length equal to or greater than crown height
G	Root formed; apical foramen still open
H	Apical foramen closed

Table 2. Average chronological, dental and skeletal age with difference significance analysis (t-test) for the whole sample

Mean chronological age (years)	10.27±0.92
Mean dental age (years)	10.72±1.82
Mean skeletal age (years)	11.84±1.18
t-test	0.001

Table 3. Average dental age, standard deviation, maximum and minimum values for samples of 9, 10 and 11 years

Chronological age (categories)	9	10	11
Dental age (years)	9.89	11.16	11.39
Standard deviation (SD)	1.21	1.86	2.16
Maximum value	13.7	14.6	14.6
Minimum value	8.3	8.8	7.7

Table 4. Average skeletal age, standard deviation, maximum and minimum values for samples of 9, 10 and 11 years

Chronological age (categories)	9	10	11
Skeletal age (years)	11.62	12.09	11.82
Standard deviation (SD)	1.37	1.02	1.10
Maximum values	13.84	14.19	14.06
Minimum values	8.54	10.45	9.39

Table 5. Average values of dental and skeletal age for 9-, 10- and 11- year olds and difference significance analysis (t-test)

Chronological age (categories)	9 godina	10 godina	11 godina
Mean dental age (years)	9.89	11.16	11.39
Mean skeletal age (years)	11.62	12.09	11.82
Significance of difference (t-test)	0.001	0.05	0.254

Results

Measurement of supporting zones in 42 patients showed that in the maxilla, 27 children (64.3%) had sufficient space, while 15 (35.7%) did not.

In the mandible, 23 children (54.8%) had sufficient space, while 19 (45.2%) did not.

Further analyses showed no statistically significant differences based on age, sex, or side of the jaw. A statistically significant difference was observed between the maxilla and mandible in certain subgroups. Nine-year-olds had sufficient space in both jaws, while 10- and 11-year-olds showed space deficiency in the mandible.

Discussion

The results show a higher prevalence of sufficient space than of insufficient space, indicating relatively favourable conditions for the second phase of tooth replacement.

The findings partially align with studies that identify caries prevalence as a major etiological factor in space loss. Differences between populations highlight the importance of selecting appropriate analytical methods.

Moyers' analysis proved clinically applicable, though caution is advised, particularly in female patients.

No significant differences were found between age groups, sexes, or sides of the jaw, supporting the idea of consistent preventive care and oral health education.

Differences between maxilla and mandible may be explained by variations in caries prevalence and oral hygiene factors.

Conclusion

The condition of supporting zones of dental arches in children in Vojvodina is satisfactory, reflecting an adequate level and trend of continuous dental care.

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