Evaluation of occlusion and orthodontic needs of thirteen-year-old children from Podlaskie voivodeship

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ABSTRACT

Purpose: One of the main research aims of epidemiological studies is to prove the prevalence of diseases and physiological conditions among people. The results of these studies enable to implement efficient prophylaxis and to plan proper health care management. Information about the prevalence of malocclusions in children and adolescents is a very important aspect of the planning of preventive care in health policy. In addition, evaluation of malocclusion allows for determining current treatment effectiveness and orthodontic treatment need after the completion of free orthodontic treatment under the Polish National Health Fund, which the legislator provided for children up to 13 years of age.

Materials and methods: The study included 500 children, aged 13 years (249 girls, 251 boys) from the Podlaskie voivodeship. The study was conducted in nine junior high schools, in a school nursing surgery using basic diagnostic tools (periodontal probe, dental mirror, laryngological spatula). The rules of Polish orthodontic diagnosis by Orlik-Grzybowska were applied in diagnosis of malocclusion. Dental abnormalities were also determined.

Results: Malocclusions were found in 57.8% of patients. 34% of children had distal occlusion belonged to the most frequent irregularities, while lingual occlusions (1.6%) was observed the most rarely. Dental abnormalities, including teeth rotations (81.8%) as most frequent were reported in 82.8% of the respondents.

Conclusions: The prevalence of malocclusion in 13 - year old school children from the Podlaskie voivodeship is high and indicates the inadequacy of orthodontic health care program. Distal occlusion is the most common malocclusion No significant differences were found between the prevalence of malocclusion and the place of residence.

Key words: malocclusion, epidemiological study, children

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INTRODUCTION

Health, including the status of the masticatory system, is the result of many factors. According to the generally accepted Dahlgren and Whitehead's model, biological factors (age, sex, genetic factors), life style, social support networks and socio-economic, cultural and environmental factors belong to these factors [1]. The guidelines of the World Health Organization (World Health Organization – WHO,) regarding oral health for 2020, relate mainly to the prevention, early detection and treatment of occlusal disorders [2]. In Poland, the main objective of the National Health Programme (NHP) for 2007-2015 is to improve the health and related quality of life of the population. One of the strategies is to intensify the prevention of tooth decay in children and adolescents. The specific objectives of oral health do not take into consideration the prevalence of malocclusion [3,4]. One of the strategic objectives of the National Programme for the Protection of the Masticatory System in 1997-2001, developed by Ministry of Health and Social Welfare, in February 1996, was to reduce the prevalence of malocclusion. It was assumed to reduce by 15% the percentage of children and adolescents compared to 1995, when the need for orthodontic treatment was observed in 60% of patients [5].

Epidemiological studies allow for evaluating the distribution and severity of morbid conditions that occur in a population. They can also check the influence of the etiological factors on the prevalence of diseases, providing the data for planning preventive and therapeutic actions. Currently, malocclusions are the third in the ranking of priorities among the problems of dental public health worldwide, surpassed only by dental caries and periodontal diseases [6].

For many years, the epidemiological studies screening occlusion disorders have been carried out by numerous authors in Poland and abroad. Analysis of the Polish literature showed a difference in the prevalence of malocclusions in children and adolescents. Simultaneously, the highest incidence of malocclusion was observed in a group of distal occlusion (according to the classification by Orlik-Grzybowska) [7-11].

However, there was no current data regarding the Podlaskie voivodeship. The last screening of occlusion in Bialystok was carried out in Białystok, the 60s of the last century [10]. In 2004, school children and adolescents were studied for the presence of posterior cross bites [12].

Objectives

Occlusal conditions were assessed to help establish current treatment effectiveness and orthodontic treatment need after the completion of free orthodontic treatment under the Polish National Health Fund, which the legislator provided for children up to 13 years of age.

MATERIALS AND METHODS

The study included 500 children (249 girls and 251 boys), aged 13 years from the Podlaskie voivodeship. Children came from 3 residential environments: a big city (> 50,000 inhabitants - BC) - 276 people, a small town (5,000-50,000 inhabitants - ST) - 199 people and a village (<5,000 inhabitants - VI) - 25 people, belonging to the county: Bialystok and Sokolka. The study was conducted in nine junior high schools, in a school nursing surgery, in daylight, using basic diagnostic tools (dental mirror, laryngological spatula and periodontal probe). Occlusal conditions of the children were evaluated by a dentist. In each case, a written consent to the examination of a child was obtained from parents or guardians.

Extraoral analysis was carried out on the basis of the facial symmetry. Kolmann's rule, Rickett's profile and Korkhaus lip step were determined [13].

Intraoral conditions were evaluated on the basis of: canine classes, Angle's class and the volume of overjet and overbite.

Malocclusion was diagnosed according to the Polish orthodontic diagnosis by Orlik-Grzybowska [14]. Dental abnormalities were also determined and divided into two groups. Dentoalveolar disproportions whose symptom was teeth crowding or their spacing represented the first group, while dental abnormalities such as eruption time, morphology, number and topography of the teeth – the second group.

The results were analyzed using Pearson's chi-square test of independence (p *) and chi-square test for linear trend (p **). Results at $p < 0.05$ were considered statistically significant. Statistics were calculated using SPSS 20.0.

The study was approved by the Bioethics Committee of the Medical University of Bialystok (RI-002/14/2014).

RESULTS

In the examined group, intact facial symmetry was observed in 329 patients (65.8%). Equality of three sections of the face (Kolmann's rule) was established in 300 children (60%). Rickett's normal profile was reported most frequently - 325 people (65%), while a moderate negative Korkhaus lip step in 338 (67%). Both Rickett's normal profile and moderate negative Korkhaus lip step occurred significantly more frequently in boys. There was also a statistically significant increase in the number of children with preserved facial symmetry and Kolmann's rule with the increased number of residence (Tab. 1).

The majority of the children had correct overjet (74.8%) and overbite (72.2%). Increased overbite was recorded in 117 children (23.4%) and concerned more frequently the children from the rural areas (28%). Enlarged overjet was observed in 132 patients (23.4%), mainly among children in the rural areas (44%). Negative overbite was revealed in 11 (1.8%), while reverse overjet in 7 patients (1.4%). Both types of overjet were not encountered in children in the rural areas.

Fang Classes I were reported markedly more frequently on both the right - 350 (70%) and the left - 344 respondents (68.8%). Fang Class II (24.7%) was observed less frequently, while class III was the least likely (4.1%). In 1.8% of children, fang classes could not be determined. No child from the rural area was qualified to this group.

Similarly, Angle's class I was the most frequently reported (73.5%), Angle's class II, more rarely (16.7%), and Angle's class III, the least frequently (8.1%). In 1.7% of the children, Angle's classes were not defined. Angle's class I was observed least frequently among the children from the rural areas. In addition, in this group, the highest percentage of children with missing sixth teeth was revealed, which prevented from assessing correctly molar classes (Tab. 1). No statistically significant relationship was found between the gender and place of residence, and the intraoral conditions investigated in the study.

Table 1. Analysis of the facial features and intraoral conditions broken down by gender and place of residence

		girls	**boys**	**p***	**VI**	**ST**	**BC**	**p****
face symmetry	correct	166 (66.7%)	163 (64.9%)	0.684	9 (36.0%)	132 (66.3%)	188 (68.1%)	0.028**
Kolmann's rule	correct	154 (61.8%)	146 (58.2%)	0.401	5 (20.0%)	109 (54.8%)	186 (67.4%)	0.000**
Rickett's profile	concave	74 (29.7%)	54 (21.5%)	0.031*	7 (28.0%)	49 (24.6%)	72 (26.1%)	0.565
	normal	158 (63.5%)	167 (66.5%)		15 (60.0%)	129 (64.8%)	181 (65.6%)	
	convex	17 (6.8%)	30 (12.0%)		3 (12.0%)	21 (10.6%)	23 (8.3%)	
Korkhaus lip step	enlarge negative	39 (15.7%)	57 (22.7%)	0.001*	10 (40.0%)	42 (21.1%)	44 (15.9%)	0.346
	medium negative	164 (65.9%)	174 (69.3%)		12 (48.0%)	123 (61.8%)	203 (73.6%)	
	positive	46 (18.5%)	20 (8.0%)		3 (12.0%)	34 (17.1%)	29 (10.5%)	
overbite	increased	50 (20.1%)	67 (26.7%)	0.213	7 (28.0%)	39 (19.6%)	71 (25.7%)	0.528
	in norm	194 (77.9%)	180 (71.7%)		18 (72.0%)	157 (78.9%)	199 (72.1%)	
	negative	5 (2.0%)	4 (1.6%)		0 (0.0%)	3 (1.5%)	6 (2.2%)	
overjet	increased	69 (27.7%)	63 (25.1%)	0.762	11 (44.0%)	47 (23.6%)	74 (26.8%)	0.440
	in norm	177 (71.1%)	184 (73.3%)		14 (56.0%)	150 (75.4%)	197 (71.4%)	
	reversed	3 (1.2%)	4 (1.6%)		0 (0.0%)	2 (1.0%)	5 (1.8%)	
canine's class / right side	cannot be defined	2 (0.8%)	9 (3.6%)	0.186	0 (0.0%)	4 (2.0%)	7 (2.5%)	0.317
	I	174 (69.9%)	176 (70.1%)		15 (60.0%)	141 (70.9%)	194 (70.3%)	
	II	61 (24.5%)	55 (21.9%)		9 (36.0%)	43 (21.6%)	64 (23.2%)	
	III	12 (4.8%)	11 (4.4%)		1 (4.0%)	11 (5.5%)	11 (4.0%)	
canine's class /left side	cannot be defined	2 (0.8%)	5 (2.0%)	0.624	0 (0.0%)	3 (1.5%)	4 (1.4%)	0.720
	I	169 (67.9%)	175 (69.7%)		17 (68.0%)	140 (70.4%)	187 (67.8%)	
	II	69 (27.7%)	62 (24.7%)		8 (32.0%)	48 (24.1%)	75 (27.2%)	

	III	9 (3.6%)	9 (3.6%)		0 (0.0%)	8 (4.0%)	10 (3.6%)	
Angle's class / right side	cannot be defined	6 (2.4%)	2 (0.8%)	0.429	3 (12.0%)	1 (0.5%)	4 (1.4%)	0.210
	I	177 (71.1%)	188 (74.9%)		13 (52.0%)	156 (78.4%)	196 (71.0%)	
	II	46 (18.5%)	40 (15.9%)		7 (28.0%)	30 (15.1%)	49 (17.8%)	
	III	20 (8.0%)	21 (8.4%)		2 (8.0%)	12 (6.0%)	27 (9.8%)	
Angle's class / left side	cannot be defined	7 (2.8%)	2 (0.8%)	0.350	2 (8.0%)	3 (1.5%)	4 (1.4%)	0.063
	I	185 (74.3%)	185 (73.7%)		16 (64.0%)	157 (78.9%)	197 (71.4%)	
	II	39 (15.7%)	42 (16.7%)		7 (28.0%)	25 (12.6%)	49 (17.8%)	
	III	18 (7.2%)	22 (8.8%)		0 (0.0%)	14 (7.0%)	26 (9.4%)	

A statistically significant relationship was proved between the normal Rickett's profile, the moderate negative Korkhaus lip step and correct overbite, and the preserved Kolmann's rule (Tab. 2).

Table 2. Relationships between Kolmann's rule and Rickett's profile, Korkhaus' lip step and overbite

	Kolmann's rule		**p***
	not retained	**retained**	
Rickett's normal profile	119 (59.5%)	206 (68.7%)	p=0.002*
medium negative Korkhaus' lip step	122 (61.0%)	216 (72.0%)	p=0.001*
normal overbite	157 (78.5%)	217 (72.3%)	p=0.035*

Children with Rickett's normal profile, correct overbite and Angle's class I and cannine's class I on both sides of the arch had significantly more likely moderately negative Korkhaus lip step (Tab. 3).

Table 3. Relationships between Kolmann's rule and Rickett's profile, Korkhaus' lip step, Angle's classes and canine's classes

	Korhaus lip step			**p***
	enlarge negative	**medium negative**	**positive**	
Rickett's normal profile	43 (44.8%)	244 (72.2%)	38 (57.6%)	p=0.000*
normal overjet	61 (63.5%)	252 (74.6%)	48 (72.7%)	p=0.000*
canine's I class / right side	55 (57.3%)	250 (74.0%)	45 (68.2%)	p=0.000*
canine's I class / left side	54 (56.3%)	248 (73.4%)	42 (63.6%)	p=0.000*
Angle's I class / right side	60 (62.5%)	261 (77.2%)	44 (66.7%)	p=0.000*
Angle's I class / right side	57 (59.4%)	272 (80.5%)	41 (62.1%)	p=0.000*

In the study of 13-year-olds, occlusion disorders were found in 289 children, 57.8% of all the examined. In some children, there was more than one malocclusion, hence the total score of malocclusions amounted to 393. Distal occlusion, the most frequent in occlusion disorders, was diagnosed in 170 patients (34%). Defects in the vertical (deep bites - 22%) were the second most numerous group of malocclusions, while cross bites - 47 (9.4%) were the third in the order of malocclusion. Lingual occlusions were the least common - 8 children (1.6%).

Dental defects, concerning dentoalveolar disproportions (crowding, spacing), were observed in 414 respondents, which accounted for 82.8%. The smallest percentage of irregularities (76%) were found in the children from the rural areas. Other dental abnormalities were detected in 464

children (92.8%), of which 100% involved children from the rural areas. In both types of dental defects the highest percentage of defects was revealed in children from small towns.

Occlusal norms excluding the presence of both occlusion and dental defects were observed in 12 children (2.4%). No malocclusion and dental defects were found in children from small towns and big cities.

Distribution of individual malocclusion and dental defects according to children's gender and place of residence is shown in Table 4. There was no statistical significance between defects and the gender or place of residence.

Table 4. Prevalence of malocclusion, dental abnormalities and normal occlusion in subjects broken down by gender and place of residence

		girls	**boys**	**p***	**VI**	**ST**	**BC**	**p****
normal occlusion		6 (2.4%)	6 (2.4%)	0.989	0 (0.0%)	5 (2.5%)	7 (2.5%)	0.630
malocclusion	distal occlusion	94 (37.8%)	76 (30.3%)	0.078	10 (40.0%)	65 (32.7%)	95 (34.4%)	0.957
	mesial occlusion	21 (8.4%)	23 (9.2%)	0.773	2 (8.0%)	18 (9.0%)	24 (8.7%)	0.981
	open bite	7 (2.8%)	7 (2.8%)	0.988	0 (0.0%)	6 (3.0%)	8 (2.9%)	0.656
	deep bite	47 (18.9%)	63 (25.1%)	0.093	7 (28.0%)	38 (19.1%)	65 (23.6%)	0.612
	cross bite	21 (8.4%)	26 (10.4%)	0.461	3 (12.0%)	23 (11.6%)	21 (7.6%)	0.148
	lingual occlusion	6 (2.4%)	2 (0.8%)	0.151	0 (0.0%)	5 (2.5%)	3 (1.1%)	0.541
dental abnormality	dentoalveolar disproportions	204 (81.9%)	210 (83.7%)	0.607	19 (76.0%)	172 (86.4%)	223 (80.8%)	0.444
	others	232 (93.2%)	232 (92.4%)	0.748	25 (100.0%)	185 (93.0%)	254 (92.0%)	0.251

Of the dentoalveolar disproportions, crowding of teeth (57.5%) was reported most frequently compared to the presence of spaces between teeth (10.3%). Crowding was more common in the lower arch (64.4%) than in the upper (50.6%). In contrast, the trems were found in the similar number of children, in the upper arch (10.6%) and the lower arch (10.0%). A statistically significant correlation was revealed between the occurrence of spaces in the upper arch and the gender (Tab. 5).

Persistent deciduous teeth were observed in 45 patients (9.0%), 26 boys (10.4%) and 19 girls (7.6%).

In a one boy (0.4%), a big city dweller, two medial upper incisors with increased dimensions were reported. Fifteen microdontic teeth were observed in 8 children (3.2%). The most common irregularity concerned the upper lateral incisors - 14 teeth. In a one child, microdontic lower central incisors were found.

Hyperdontia in the form of the middle tooth (mesiodens) occurred in a one boy (0.4%) from a small town. Hyperdontia was observed in five patients (1.0%) from small towns and big cities, who had 8 permanent teeth gaps – 5 of second premolars and 3 lateral incisors.

Incompatibility of dental midline with regard to the midline of the face was observed in 41.9% of children. In the upper arch, this irregularity concerned more girls (47.4%), which was confirmed statistically. In the lower arch, this finding was revealed in a similar number of girls (44.2%) and boys (43.0%). Diastema was reported more frequently in the upper arch (12%) than in the lower arch (4%).

In a one boy (0.4%) from a small town, transposition of the canine with lateral incisor was revealed. Reinclusion of lower second primary molars was observed in two boys (0.8%) from a big city. Protrusion of 486 incisors was reported in 64 girls (25.7%) and 62 boys (24.7%), affecting more frequently the upper teeth (353 teeth). Retrusion of 353 incisors occurred in 49 girls (19.7%) and 51 boys (20.3%), more frequently in the upper arch (258 teeth). A total of 22 girls (8.8%) and 34 boys (13.5%) had 76 ectopic teeth, 53 of them located in vestibule, 18 – in palatal and 5 – in lingual positions.

Teeth rotations (81.8%) were the most common irregularities, reported in slightly more girls (84.7%). A total of 2,165 teeth were rotated, of which 1,302 belonged to the lower arch. Rotated incisors constituted the largest group - 943, then, upper incisors - 650, successively, lower canines - 279, upper canines – 193 and finally, premolars and molars - 20.

The number of children with retrusion and rotations of teeth was observed to decrease with the increasing size of residence. This relationship was confirmed statistically (Tab. 5).

Table 5. Prevalence of dental abnormalities by gender and place of residence

		girls	**boys**	**p***	**VI**	**ST**	**BC**	**p****
dentoalveolar disproportions	crowding in the upper arch	134 (53.8%)	119 (47.4%)	0.152	10 (40.0%)	110 (55.3%)	133 (48.2%)	0.545
	crowding in the lower arch	161 (64.7%)	161 (64.1%)	0.904	17 (68.0%)	132 (66.3%)	173 (62.7%)	0.373
	spacing in the upper arch	17 (6.8%)	36 (14.3%)	0.006*	2 (8.0%)	25 (12.6%)	26 (9.4%)	0.523
	spacing in the lower arch	19 (7.6%)	31 (12.4%)	0.079	3 (12.0%)	22 (11.1%)	25 (9.1%)	0.435
time eruption disorders	the presence of persistent deciduous teeth	19 (7.6%)	26 (10.4%)	0.287	1 (4.0%)	18 (9.0%)	26 (9.4%)	0.525
size disorders	macrodontics	0 (0.0%)	1 (0.4%)	0.319	0 (0.0%)	0 (0.0%)	1 (0.4%)	0.400
	microdontics	2 (0.8%)	6 (2.4%)	0.157	0 (0.0%)	5 (2.5%)	3 (1.1%)	0.541
number disorders	hypodontia	2 (0.8%)	3 (1.2%)	0.660	0 (0.0%)	3 (1.5%)	2 (0.7%)	0.699
topography disorders	incompatibility midline in the upper arch	118 (47.4%)	83 (33.1%)	0.001*	8 (32.0%)	86 (43.2%)	107 (38.8%)	0.770
	incompatibility midline in the lower arch	110 (44.2%)	108 (43.0%)	0.796	10 (40.0%)	79 (39.7%)	129 (46.7%)	0.145
	diastema in the upper arch	29 (11.6%)	31 (12.4%)	0.809	1 (4.0%)	21 (10.6%)	38 (13.8%)	0.110
	diastema in the lower arch	8 (3.2%)	12 (4.8%)	0.371	0 (0.0%)	10 (5.0%)	10 (3.6%)	0.988
	protrusion	64 (25.7%)	62 (24.7%)	0.796	12 (48.0%)	46 (23.1%)	68 (24.6%)	0.207
	retrusion	49 (19.7%)	51 (20.3%)	0.858	7 (28.0%)	47 (23.6%)	46 (16.7%)	0.034 **
	ectopy	22 (8.8%)	34 (13.5%)	0.095	1 (4.0%)	23 (11.6%)	32 (11.6%)	0.489
	rotation	211 (84.7%)	198 (78.9%)	0.090	22 (88.0%)	171 (85.9%)	216 (78.3%)	0.027 **

A statistically significant correlation was established between the rotation of teeth and their crowding in both dental arches (Tab. 6).

Table 6. The relationship between the occurrence of rotation and the presence of dental crowding

	Rotations		p*
	yes	**no**	
crowding in the upper arch	9 (9.9%)	244 (59.7%)	p=0.000*
crowding in the lower arch	9 (9.9%)	313 (76.5%)	p=0.000*

DISCUSSION

The rules of the Polish orthodontic diagnosis allow for the initial diagnosis of orthodontic condition during screening. Orthodontic extraoral and intraoral analysis and functional examination can easily be carried out in a school nursing surgery. Analysis of the definition of malocclusion in line with the findings of the International Commission for Unification of Orthodontic Systematics of the World Health Organization, stating "malocclusion is a state of the masticatory system that limits the action of chewing and breathing and/or is felt by the patient as a disfigurement", reveals the difficulty in comparing Polish and foreign studies [11]. Moreover, Polish authors, in their studies, frequently used a different classification than Orlik-Grzybowska. Angle's

classification and severity of malocclusion, divided into good and bad occlusion or the WHO classification were frequently applied in the studies [15-18].

The Polish stricter criteria for diagnosis, based on the biological norm, compared to tests carried out in centres abroad, had no influence on a significant difference in the study results, compared to the data presented by American, Brazilian or Indian authors [19-21]. Class II malocclusion, found in 170 children, representing 34%, was the most frequently observed. A similar percentage of these defects was revealed among Asian kids - about 33% [22], 27.5% [23] and European kids - 29.2% [24]. Similarly, crowding, as the most common dental defect, was diagnosed in 57.5% of children, which was confirmed in other authors' reports - 46.4% [25], 53% [22], 54% [26].

The orthodontic study included 13-year-old children, residing in the areas with different distances from dental offices. The access to specialist orthodontic consultation was limited, especially in the rural areas. The low health awareness of parents and guardians manifesting itself in lack of interest in children's state of dentition may be associated with the relatively high prevalence of occlusion-tooth defects among the study children (82.8%). A high percentage of defects may result from inadequate prevention and unsatisfactory or ineffective treatment of children covered by the survey.

The prevalence of malocclusion and dental abnormalities in the study of 13-year-old children was comparable with the values reported in national publications based on the similar evaluation criteria, from 53.3% in the Szczecin region to 93% in Bielsko-Biala [27,28]. The nationwide epidemiological study of the masticatory system in 1995 revealed occlusion-tooth defects in 63.7% of 12-year olds [17,29]. In each of these studies, there was a different number of participants in each study, from 120 [27] to 1,860 children [17]. Comparing the occlusion study in children from the area of present Podlasie region, an increase in the percentage of children with malocclusions (57.8%) was observed in comparison with the study performed in 1969 (32.9%) [10].

A similar pattern was revealed in the Dolnoslaskie voivodeship, where the percentage of occlusive disorders in 1992 accounted for 50.6% and was almost twice as high as a few years earlier. In the former voivodeship of Szczecin - after 8 years, there was an increase in the percentage of occlusal abnormalities from 33.3% to 53.3% [7].

Although the results of individual occlusion studies are impossible to compare in detail due to the different populations and age classification used, it undoubtedly contributes greatly to the overall understanding of the epidemiology of malocclusion. A large percentage of children with occlusion-tooth defects suggests the need for reflection on existing orthodontic care in Poland - the availability and effectiveness of treatment. Orthodontic prevention is also significant, combating various forms of dysfunction or parafunctions from an early age. Healthy teeth constitute the foundation of the proper condition of occlusion. Thus, a major role is attributed to the treatment of primary teeth, protecting against tooth decay and furrows in newly erupted permanent teeth, early treatment of dental caries and tooth injury prevention. In the case of premature loss of baby teeth or neglect of hygiene leading to a reduction in the number of permanent teeth in children, appropriate steps should be undertaken to correct further development of the masticatory system.

The report of the Supreme Audit Office of 2013 year states that the five-year study of children conducted in 2011 showed that only 20.1% of them were free of tooth decay. In the opinion of the Supreme Audit Office, this situation was significantly affected by insufficient health education and disease prevention. The report showed that only 2.96% of the population of children and adolescents in 2011 benefited from guaranteed preventive services financed from public funds [30].

CONCLUSIONS

1. In the region of Podlasie, the consequences of inadequate orthodontic treatment were reported. Despite existing free care under the Polish National Health Fund for children up to the age of 13, the prevalence of malocclusion and dental defects have still been high.
2. The study proved that the highest number of children had posterior occlusion, which confirms that distal occlusions are still the most common malocclusions.
3. There was no correlation between the place of residence and the prevalence of malocclusion, which may illustrate the map of orthodontic surgeries in the Podlaskie voivodeship and confirm the awareness of parents, guardians and patients themselves regarding treatment of dental irregularities.

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Conflicts of interest

The authors declare that there are no conflicts of interest of this paper.

REFERENCES

1. Dalhgren G, Whitehead M. Polices and Strategies that Promote Social Equity in Health. Stockholm: Institute for Futures Studies; 1991.
2. Hobdell M, Petersen PE, Clarkson J, Johnson N. Global goals for oral health 2020. Int Den J. 2003 Oct;53:285-8.
3. Adamowicz-Klepalska B, Wierzbicka M, Strużycka I. Expected foundations of the national health policy for 2006-2020. Czas Stomatol. 2005;58(6):457-60.
4. National Health Programme for 2007-2015. Annex to Resolution No. 90/2007 of the Council of Ministers of 15 May 2007.
5. Wierzbicka M, Adamowicz-Klepalska B, Piekarczyk J, Pisulska-Otręba A, Spiechowicz E, M. Ziętek . National masticatory system protection program in the period 1997-2001. Czas Stomatol. 1999;53(4):271-81. (Polish)
6. Dias PF, Gleiser E. O índice de necessidade de tratamento ortodôntico como um método de avaliação em saúde pública. Rev Dental Press Ortod Ortop Facial. 2008 Jan/Feb.;13(1):74-81.
7. Karolonek M, Matthews-Brzozowska T. Prevalence of malocclusion in schoolchildren in Poland and in the world - a review of the literature. Stom Współcz. 2006; Suppl. 2:23-6. (Polish)
8. Kawala B, Szumielewicz M, Kozanecka A. Are Orthodontists Still Needed? Epidemiology of Malocclusion Among Polish Children and Teenagers in Last 15 Years. Dent Med Probl. 2009;46(3):273-8. (Polish)
9. Kozanecka A, Kavala B: Incidence of malocclusions vs. orthodontic treatment need among young Polish adults - literature review. J Stomatol. 2012;65(3):424-434.
10. Falińska M. Prevalence maxillo -occlusal abnormalities in children Bialystok. Czas Stomatol. 1969;22:1195-7. (Polish)
11. Colonna-Walewska M. Assessment of the prevalence of acoustic symptoms within the temporomandibular joints in school-going population with co-existing malocclusion. Czas Stomatol. 2008;61(4):260-6. (Polish)
12. Bugała-Musiatowicz B, Kalinowska M. Posterior cross bite - epidemiological study in primary school children in Bialystok. Nowa Stomat. 2004;4(4):157-60. (Polish)
13. Proffit WR, Fields HW, Sarver DM. Contemporary orthodontisc. 4th ed. Elsevier Inc; 2007.
14. Orlik-Grzybowska A. Fundamentals of orthodontics. Warsaw. National Institute of Medical Publishing; 1976. (Polish)
15. Malejewska D, Frączak B, Kubrak J, Lewandowska M, Szadziuk L, Zawojski R. Evaluation of masticatory system in students Maritime University in Szczecin. Protet Stomatol. 1990;40(1):13-7. (Polish)
16. Emerich-Poplatek K, Adamowicz-Klepalska B, Kaczmarczyk J, Maraszkiewicz-Kulesza M. The state of occlusion in the population with developing dentition in the Gdanskie voivodeship. Czas Stomatol. 1999;52(5):301-6. (Polish)
17. Suszczewicz A, Lisiecka K. The occlusion state of 12- and 18-year-old population in Poland in 1995. Prz Stomatol Wieku Rozw. 2001;3-4:20-3. (Polish)
18. Nawrocka-Furmanek J, K Rusiniak-Kubik, Godlewski T Mierzwińska-Nastalska E, Kostrzewa-Janicka J, Zubrzycki P, Wojtyńska E. Occurrence of parafunctions and dysfunction in relation to the occlusal dentistry students. Protet Stomatol. 2004;54:152-61. (Polish)
19. Proffit WR, Fields HW, Moray LJ. Prevalence of malocclusion and orthodontic treatment need in the United States. Int J Adult Orthod Ortogn Surg. 1998;13(2):97-106.
20. Brito DB, Dias PF, Gleiser R. Prevalence of malocclusion in children aged 9 to 12 years old in the city of Nova Friburgo, Rio de Janeiro State, Brasil. R Dental Press orthodontic Ortop Facial. 2009;14(6):118-24.
21. Shivakumar KM, Chandu GN, Shafiulla MD. Severity of Malocclusion and Orthodontic Treatment Needs among 12- to 15-Year-Old School Children of Davanger District, Karnataka, India. Eur J Dent. 2010;7(4):298-307.
22. Singh VP, Sharma A. Epidemiology of Malocclusion and Assessment of Orthodontic Treatment Need for Nepalese Children. International Scholarly Research Notices, 2014, Article ID 768357, 4 pages, 2014.
23. Borzabadi-Farahani A, Borzabadi-Farahani A, Eslamipour F. Malocclusion and occlusal traits in an urban Iranian population. An epidemiological study of 11- to 14-year-old children. Eur J Orthod. 2009 Oct;31(5):477-84.
24. Laganà G, Masucci C, Fabi F, Bollero P, Cozza P. Prevalence of malocclusions, oral habits and orthodontic treatment need in a 7- to 15-year-old schoolchildren population in Tirana. Prog Orthod. 2013 Jun 14;14:12.
25. Sanadhya S, Chadha M, Chaturvedi MK, Chaudhary M, Lerra S, Meena MK, Bakutra G, Acharya S, Pandey A, Tak M, Asawa K1, Kamate S. Prevalence of malocclusion and orthodontic treatment needs among 12-15-year-old schoolchildren of fishermen of Kutch coast, Gujarat, India. Int Marit Health. 2014;65(3): 106-13.
26. Shalish M, Gal A, Brin I, Zini A, Ben-Bassat Y. Prevalence of dental features that indicate a need for early orthodontic treatment. Eur J Orthod. 2013 Aug;35(4):454-9.

27. Rojek R, Lisiecka K, Suszczewicz A. The condition bite of Szczecin 12-year-olds based on epidemiological studies. Przegl Stomatol Wieku Rozw. 2001;3-4:31-4. (Polish)
28. Truszel M, Roztoczyńska A. Assessment of the masticatory system of 12-year-old children in Bielsko-Biala. Mag Stomatol. 2002;10:48-52. (Polish)
29. Jańczuk Z. Masticatory system status of the Polish population. Nowa Stomat. 1997;3:45-9. (Polish)
30. The NIK report: Availability and dental care financing from public funds. https://www.nik.gov.pl/plik/id,5280,vp,6841.pdf [cited 2015 June 25].