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ANALYSIS OF THE NEEDS FOR ORTHODONTIC TREATMENT OF CHILDREN FROM SOCIALLY VULNURABLE GROUPS OF ALMATY AND ALMATY REGION

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Abstract

Introduction: The most important criterion for children's and adolescents' dental health condition is the prevalence of dental anomalies (DA) which are accompanied by psychosocial disorders in children. It is relevant to study the need for DA treatment with the help of DAI (Dental Aesthetic Index).

The purpose of the study was to assess the need for orthodontic treatment of orphans in Almaty and Almaty region.

Methods: 461 Almaty and Almaty region residents aged 12-18 years old were examined, including 144 teenagers aged 11-12 years old, 82 teenagers aged 14-15 years old and 235 children of senior school teenagers aged 17-18 years old. The severity of DA was determined with the help of DAI.

Results: Most often, the examined patients had crowding of teeth and lower jaw deviations with increasing frequency by age. In the absolute majority of the surveyed, the DAI was below 25%: in 64% of adolescents aged 11-12, in 78.0% of the surveyed aged 14-15, and equally often in 17-18-year-olds. In 30% of children aged 11-12 years, the value of the indicator was 26-30% - there were obvious violations in the dentoalveolar system, which required orthodontic treatment. The proportion of such children in the group of 14-15 years old was lower - 18.0%, among older students - 14.0%.

The DAI value at the level of 31-35 was detected in 4% of children aged 14-15 years and in 6% of 17-18 years old, in the group of 11-12 years old - none was detected. With age, the value of the indicator in girls tended to decrease. The proportion of boys with a DAI value over 31 in the group of 11-12 years old was 10.0%, then at 14-15 years old - 6.7%, and in 17-18 years old it increased, summing to a total of 23.5%, of which 17.7% DAI was in the range of 31-35, 5.8% - over 36 (extremely high need for orthodontic intervention).

Conclusions: A high prevalence of DA among adolescents from Almaty and Almaty region coming from socially unprotected groups was revealed. Up to 30% of 12-year-olds and 32% of 18-year-olds of the examined children need orthodontic care.

Keywords: *dentoalveolar anomalies, orthodontic treatment, adolescents, crowding of teeth, interdental spaces.*

Резюме

АНАЛИЗ ПОТРЕБНОСТИ В ОРТОДОНТИЧЕСКОМ ЛЕЧЕНИИ ДЕТЕЙ ИЗ СОЦИАЛЬНО НЕЗАЩИЩЁННЫХ ГРУПП Г. АЛМАТЫ И АЛМАТИНСКОЙ ОБЛАСТИ

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Введение: Важнейшим критерием состояния стоматологического здоровья детей и подростков является распространенность зубочелюстных аномалий (ЗЧА), которые сопровождаются психосоциальным нарушениями у детей. Актуальным является изучение нуждаемости в лечении ЗЧА с помощью индекса DAI (Dental Aesthetic Index).

Цель исследования - оценка необходимости проведения ортодонтического лечения детей-сирот в г. Алматы и в Алматинской области.

Методы: Обследован 461 житель города Алматы и Алматинской области в возрастной группе 12-18 лет, в том числе 144 ребенка в подростковом возрасте 11-12 лет, 82 ребенка в подростковом возрасте 14-15 лет и 235 детей старшего школьного возраста 17-18 лет. Степень выраженности ЗЧА определяли с помощью индекса DAI.

Результаты: Чаще всего у обследуемых отмечались скученность зубов и отклонения нижней челюсти, их частота увеличивалась с возрастом. У абсолютного большинства обследуемых величина индекса DAI была ниже 25%: у 64% подростков 11-12 лет, у 78,0% обследуемых 14-15 лет, и столь же часто и 17-18-летних. У 30% детей 11-12 лет значение показателя составило 26-30% - наблюдались явные нарушения в зубочелюстной системе, что требовало проведения ортодонтического лечения. Доля таких детей в группе 14-15 лет была ниже - 18,0%, среди старших школьников - 14,0%.

Значение DAI на уровне 31-35 было выявлено у 4% детей в возрасте 14-15 лет и в 6% случаях у обследуемых 17-18 лет, в группе 11-12 лет - ни у кого не выявлено. С возрастом величина показателя у девочек имела тенденцию к снижению. Доля мальчиков с величиной DAI свыше 31 в группе 11-12 лет составила 10,0%, затем в 14-15 лет - 6,7%, а у 17-18 летних возросла, составила в сумме 23,5%, из них у 17,7% DAI был в диапазоне 31-35, у 5,8% - свыше 36 (крайне высокая нуждаемость в ортодонтическом вмешательстве).

Выводы: Показана высокая распространенность ЗЧА у подростков города Алматы и Алматинской области из социально незащищенных групп. До 30% 12-летних и 32% 18-летних детей обследованных детей нуждаются в оказании ортодонтической помощи.

***Ключевые слова**: зубочелюстные аномалии, ортодонтическое лечение, подростки, скученность зубов, межзубные промежутки.*

Түйіндеме

АЛМАТЫ ҚАЛАСЫ ЖӘНЕ АЛМАТЫ ОБЛЫСЫ БОЙЫНША ӘЛЕУМЕТТІК ОСАЛ ТОПТАРДАҒЫ БАЛАЛАРҒА ОРТОДОНТИЯЛЫҚ ЕМ ҚАЖЕТТІЛІГІН ТАЛДАУ

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Кіріспе: Балалар мен жасөспірімдердің стоматологиялық денсаулығының маңызды көрсеткішінің бірі болып тіс-жақ аномалияларының (ТЖА) таралуы болып табылады, олар балалардағы психоәлеуметтік бұзылыстармен қатар жүреді. DAI (Dental Estetic Index) индексінің көмегімен ТЖА емдеу қажеттілігін зерттеу өзекті мәселе болып табылады.

Зерттеу мақсаты – Алматы қаласы мен Алматы облысындағы жетім балаларға ортодонтиялық ем жүргізу қажеттілігін бағалау.

Зерттеу әдістері: Алматы қаласы мен Алматы облысының 12-18 жас аралығындағы 461 тұрғыны, сонымен қатар 144 жасөспірім 11-12 жас шамасында, 82 жасөспірім 14-15 жас шамасында және 235 ересек 17-18 жас шамасындағы мектеп жасындағы балалар зерттелген. ТЖА-ның ауырлық дәрежесі DAI индексі арқылы анықталды.

Нәтижелер: Көбінесе тексерілген зерттенушілерде тістердің жиырылуы мен төменгі жақ ауытқулары байқалды, олардың жиілігі жасына қарай артқан. Зерттеуге қатысқандардың абсолютті көпшілігінде DAI индексінің көлемі 25%-дан төмен болған: 11-12 жас аралығындағы жасөспірімдердің 64%-да, 14-15 жас аралығындағы зерттеуге

қатысқандардың 78,0%-да және 17-18 жас аралығындағы жасөспірімдерде дәл сондай жиілікпен кездескен. 11-12 жас аралығындағы балалардың 30% -ында көрсеткіш мәні 26-30% құрады – бұл жерде ортодонтиялық ем жүргізуді қажет ететін тіс-жақ аномалияларының айқын бұзылыстары бар екендігі анықталған. 14-15 жас тобындағы мұндай балалардың үлесі төменірек болды - 18,0%, жоғарғы буын мектеп оқушылары арасында - 14,0%.

DAI мәні 31-35 деңгейінде 14-15 жас шамасындағы балалардың 4% -ында және зерттелген 17-18 жас аралығындағы балалардың - 6% жағдайында анықталған, 11-12 жас аралығындағы топта анықталған жоқ. Жасы ұлғайған сайын қыздарда көрсеткіш мәнінің төмендеу үрдісі байқалған. 11-12 жас тобындағы 31-ден жоғары DAI көрсеткіші бар ұлдардың үлесі 10,0%, одан кейін 14-15 жас аралығында - 6,7%, ал 17-18 жастағыларда өскен, барлығы 23,5%-ды құрады, олардың ішінде 17,7%-ында DAI 31-35 диапазонында болды, 5,8%ында - 36-дан жоғары (ортодонтиялық емге өте жоғары қажеттілік) көрсеткен.

Қорытынды: Алматы қаласы мен Алматы облысының жасөспірімдерінің әлеуметтік қорғалмаған топтарының арасында ТЖА-ның жоғары таралуы көрсетілген. Тексерілген балалардың ішінде, 12 жастағылардың 30%-ы және 18 жастағылардың 32% -ы ортодонтиялық көмекті қажет етеді.

Түйінді сөздер: тіс-жақ аномалиялары, ортодонтиялық ем, жасөспірімдер, тістердің жиырылып орналасуы, тіс аралық кеңістіктер

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Introduction

Currently, many experts believe that one of the most significant criteria for the dental health's state of children and adolescents is the prevalence of dental anomalies (DA) [8,9,1,2]. According to the literature, dental anomalies are widespread among adolescents in various countries and regions [9,1,6]. These include anomalies in the dentition, anomalies in the shape of the dentition, anomalies in the number, shape of individual teeth, anomalies in the hard and soft tissues of the oral cavity.

It has been established that almost every second child under the age of 14 and every third adult needs orthodontic treatment [17,12,6], while the results of epidemiological studies indicate a trend towards an increase in the incidence of orthodontic pathology in adults and children [1,12,3,13,15].

In the structure of dentoalveolar anomalies, there is an increase in the proportion of occlusion disorders, often combinations of general somatic pathology with malocclusion are detected, which determines the need for an interdisciplinary study of the problem under consideration, in particular, a comprehensive examination and the choice of individual tactics when planning orthodontic treatment [6,3].

Anomalies of the bite are characterized by misalignment of teeth and dentoalveolar inconsistencies. Their high prevalence among children is often combined with impaired quality of life in children, which was shown in a number of studies using special indices [5,11,16,19]. At the same time, it has been demonstrated that in children and adolescents, dentoalveolar anomalies are often accompanied by dissatisfaction with their own appearance and psychosocial disorders, affecting self-esteem and perception of children in society [18,10]. At the same time, it should be taken into account that children aged 11-12 years old are going through a critical period in their lives, when appearance becomes very important for their peers' perception and self-esteem. During this period, the social life of adolescents becomes more intense, appearance affects the development of social ties, their peers consider physically attractive people to be more friendly, interesting and sociable [18]. In this regard, adolescents with unsatisfactory dental aesthetics experience great difficulties in social life, being in a more disadvantaged position compared to children who do not have such problems. [11,10].

Previously, the indication for orthodontic treatment was to determine the type of occlusion and disocclusion of the dentition: mesial, distal, open, deep and cross. Currently, the Dental Aesthetic Index (DAI) recommended by World Health Organization (WHO) is used in orthodontics. DAI was introduced in 1986 at the Iowa State University College of Medicine. Specialists of the WHO consider DAI as a cross-cultural indicator that can be used when examining various ethnic groups [7, 14].

The purpose of the study was to assess the need for orthodontic treatment of orphans in Almaty and Almaty region.

Materials and methods. 461 residents of Almaty city and Almaty region in the age group of 12-18 years old were examined, including 144 children in adolescence 11-12 years old (58 boys and 86 girls), 82 children in adolescence 14-15 years old (32 boys and 50 girls) and 235 children of senior school age 17-18 years old, including 120 boys and 115 girls.

The severity of dentoalveolar anomalies was determined using the DAI (Dental Aesthetic Index), proposed in 1986 at the Medical College of the University of Iowa.

DAI values were calculated according to the formula recommended by WHO:

$$DAI=(A\cdot 6)+B+C+(D\cdot 3)+E+F+(G\cdot 3)+(H\cdot 4)+(I\cdot 3)+13,$$

where: A - missing teeth, B - crowding, C - trema, D - diastema, E - maximum anterior deviation in the upper jaw, F - maximum anterior deviation in the lower jaw, G - anteromandibular overlap, H - vertical anterior gap, I - anteroposterior ratio of molars, 13 - constant.

Depending on the DAI value, patients were divided into 4 groups: no need for treatment (DAI < 25); selective treatment (26 ≤ DAI ≤ 30); treatment recommended (31 ≤ DAI ≤ 35); mandatory treatment (DAI ≥ 36). Thus, if the DAI value ≥ 26, the patient was considered in need of orthodontic treatment.

Statistical data processing was carried out using the computer software STATISTICA 10 for Windows (StatSoft, USA). Intergroup comparisons for categorical parameters were performed using the chi-square test.

Results. The analysis of the frequency of dentoalveolar anomalies' detection in the examined children showed that most often they had crowding of teeth – in 55.4% of children in the age group of 11-12 years, in 33.0% of the examined group of 14-15 years and in 39.4% of the examined senior school age (Figure 1). At the same time, the value of the indicator in the group of 14-15-year-old was statistically significantly lower ($p<0.05$) than in the group of children aged 11-12.

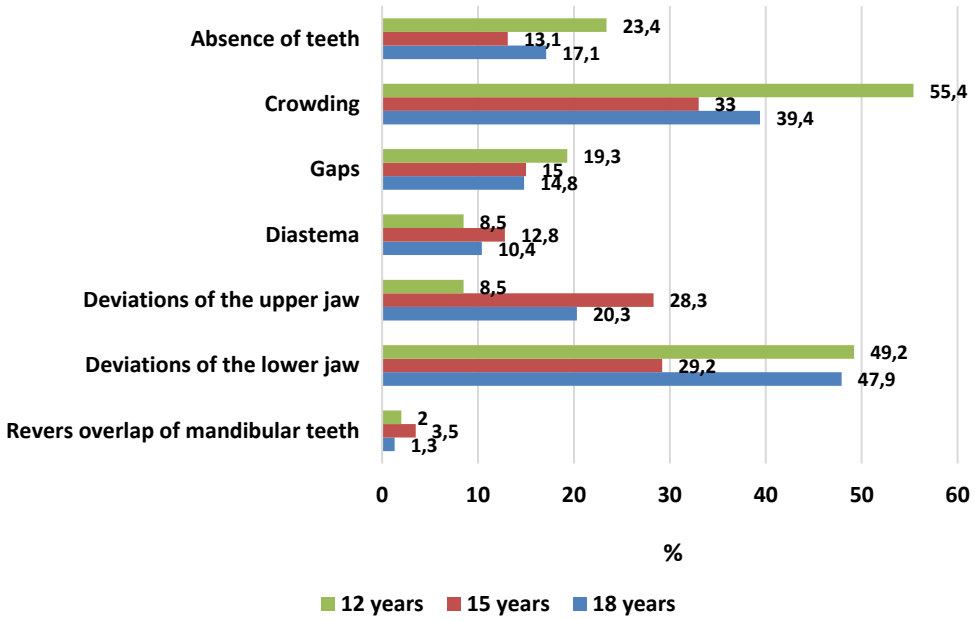

Figure 1. The overall frequency of detection of dentoalveolar anomalies in adolescents and senior school age children (%)

Deviations of the lower jaw were also often detected – in 49.2% and 47.9% of cases in the age groups of 11-12 and 17-18 years, respectively. At the same time, in adolescents aged 14-15, this anomaly was detected less frequently – in 29.2% of the subjects.

Attention was drawn to a statistically significant ($p<0.05$) increase with age in the frequency of detection of deviations of the upper jaw from 8.5% in the group of adolescents aged 11-12 to 28.3% and 20.3%, respectively, in the groups of subjects aged 14-15 and 17-18 years old. Missing teeth and gaps were slightly more common in the younger age group. At the same time, there were no statistically significant intergroup differences depending on age for most indicators.

The assessment of the values of these indicators did not reveal statistically significant intergroup differences depending on the gender of the subjects (Table 1).

Table 1.

The frequency of detection of dentoalveolar anomalies detection in adolescents and children of senior school age, female and male (%).

Indicators	11-12 years		14-15 years		17-18 years	
	Girls (n=86)	Boys (n=58)	Girls (n=50)	Boys (n=32)	Girls (n=115)	Boys (n=120)
1. Absence of teeth (%)	21,2	25,0	14,2	12,0	20,0	14,2
2. Crowding (%)	52,1	58,7	35,0*	31,0*	41,0	37,7
3. Gaps (%)	17,3	21,2	12,6	17,4	13,4	16,2
4. Diastema (%)	6,7	10,3	13,3	12,3	9,0	11,9
5. Deviations of the upper jaw (%)	9,2	7,8	13,2	15,1	19,3*	21,2*
6. Deviations of the lower jaw (%)	40,5	57,8	24,8	33,5	47,0	48,8
7. Reverse overlap of mandibular teeth (%)	2,3	1,7	4,0	3,1	1,7	0,8
8. Front vertical slot (%)	-	-	-	-	-	-

Примечание: * - различия статистически значимы ($p<0,05$) по сравнению со значением показателя в группе 11-12 лет по критерию $\chi 2$ (хи-квадрат).

At the same time, both in boys and girls, there was a statistically significant (p<0.05) decrease in the frequency of crowding of teeth at the age of 14-15 years compared to similar values in the age group of 11-12 years, as well as an increase (p<0, 05) the frequency of manifestation of such a sign as deviations of the upper jaw in the age group of 17-18 years compared with the corresponding levels in 11-12 year old children.

The analysis of various characteristics of crowding of teeth in the examined children showed that most often they had crowding of the lower dentition, crowding of the dentition in both segments and the presence of interdental spaces of the upper dentition (Figure 2). At the same time, there were no significant age-related dynamics and statistically significant intergroup differences depending on age in terms of the characteristics of crowding of the dentition and interdental spaces.

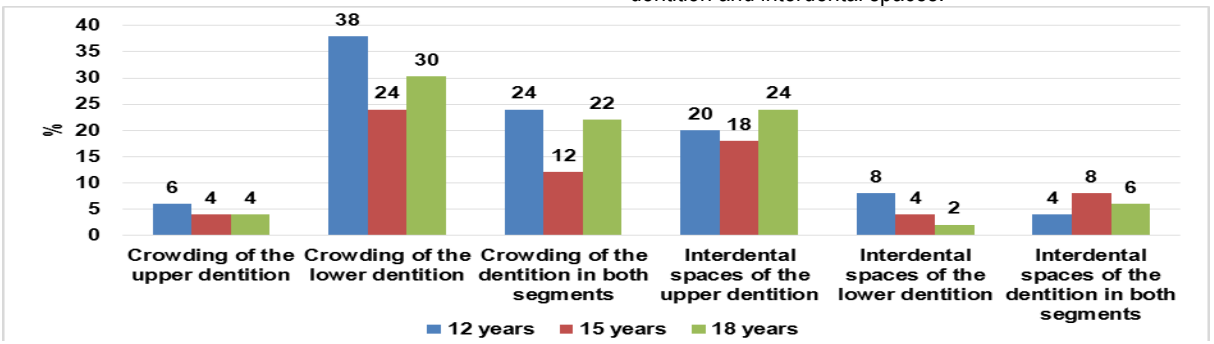

Figure 2. Characteristics of teeth crowding and interdental spaces in adolescents and older children of female and male gender (%).

The study of the features of crowding of teeth depending on the sex of the examined children showed that cases of crowding of the upper dentition were observed only in girls (Table 2). The crowding of the lower dentition and crowding in both segments did not significantly differ in frequency in the groups of the examined, except that in the group of 14-15-year-old girls the frequency of crowding of the dentition in both segments was significantly (2-3 times) higher (p<0 .05) than in boys, as well as in comparison with the corresponding indicator in other age groups of girls.

Table 2.

Characteristics of teeth crowding and interdental spaces in general samples of adolescents and senior school age children (%).

Indicators	11-12 years		14-15 years		17-18 years	
	Girls (n=86)	Boys (n=58)	Girls (n=50)	Boys (n=32)	Girls (n=115)	Boys (n=120)
1. Crowding of the upper dentition (%)	10,0	-	6,7	-	6,1	-
2. Crowding of the lower dentition (%)	36,7	40,0	26,7	20,1	36,4	23,5
3. Crowding of the dentition in both segments (%)	26,7	20,0	67,0*	20,0	18,2#	24,4
4. Interdental spaces of the upper dentition (%)	13,3	30,0	16,7	20,0	24,4	23,5
5. Interdental spaces of the lower dentition (%)	6,7	10,0	6,7	-	3,0	-
6. Interdental spaces of the dentition in both segments (%)	-	10,0	3,3	15,0	3,0	11,8

Примечание:

* - различия статистически значимы (p<0,05) по сравнению со значением показателя в группе 11-12 лет по критерию χ2 (хи-квадрат)

- различия статистически значимы (p<0,05) по сравнению со значением показателя в группе 14-15 лет по критерию χ2 (хи-квадрат)

There were no significant age-related dynamics and statistically significant intergroup differences depending on age in terms of the characteristics of crowding of the dentition and interdental spaces.

Comparison of the characteristics of interdental spaces showed that, in general, in groups of 11-12 and 14-15 years old, they were more common in groups of boys than girls, while in the group of 17-18 year olds, the overall frequency of their detection did not differ significantly.

The study of the size of the maxillary overlap did not reveal significant differences in the groups of the examined, depending on the age of the children (Figure 3).

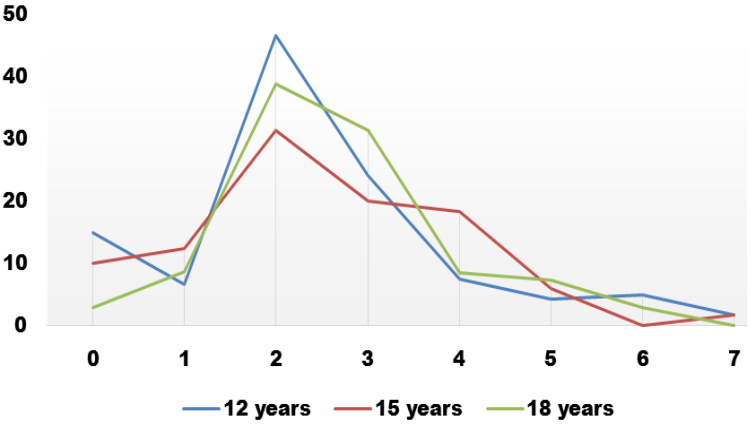

Figure 3. Distribution of subjects in general samples by the size of the maxillary overlap (%).

The assessment of the distribution of children by the size of the maxillary overlap, depending on gender, showed that in 15% and 20% of boys in the age groups of 11-12 and 14-15 years, respectively, the value of this indicator was 0 (Table 3). At the same time, among girls, such cases were detected only in the age group of 17-18 years, the value of the indicator was 3.0%. However, among girls of all age groups, there were more of those surveyed with minimal levels of this indicator (1-2 mm) than among boys. However, there were no statistically significant differences in the size of the maxillary overlap depending on the sex of the children.

Table 3.

Distribution of subjects depending on gender according to the size of the maxillary overlap (%).

The value of the maxillary overlap, mm	11-12 years		14-15 years		17-18 years	
	Girls (n=86)	Boys (n=58)	Girls (n=50)	Boys (n=32)	Girls (n=115)	Boys (n=120)
0 mm	-	15,0	-	20,0	3,0	-
1 mm	6,7	-	20,0	5,0	6,1	11,2
2 mm	53,3	40,0	43,0	20,0	42,4	35,3
3 mm	23,3	25,0	10,0	30,0	33,3	29,4
4 mm	10,0	5,0	16,7	20,0	12,1	5,8
5 mm	3,3	5,0	6,7	5,0	3,0	11,7
6 mm	-	10,0	-	-	-	5,8
7 mm	3,3	-	3,3	-	-	-

The assessment of the distribution of the subjects according to the value of the DAI index showed that in the absolute majority of them the value of this indicator was below 25%: in 64% of adolescents aged 11-12, in 78.0% of the subjects aged 14-15, and just as often in the subjects of high school students. age (Figure 4). That is, in these adolescents and older schoolchildren, violations were either absent or were minor and did not require orthodontic intervention.

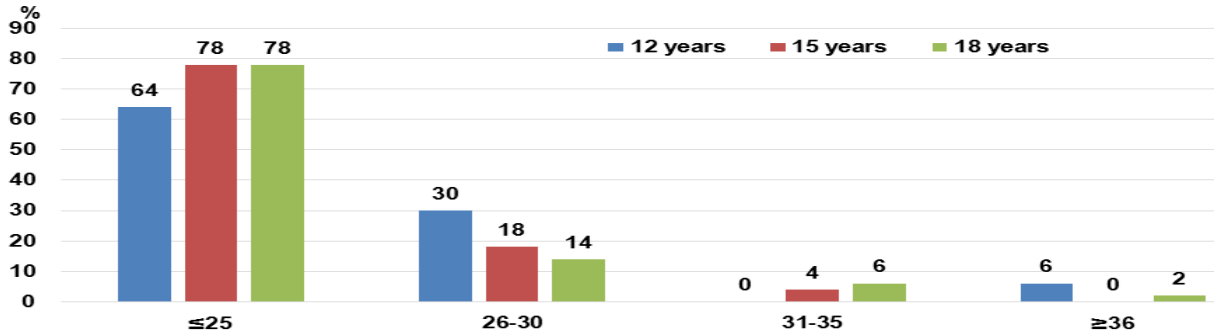

Figure 4. Distribution of subjects in general samples by the value of total value of DAI index (%).

In 30% of children in the age group of 11-12 years, the value of the indicator was at the level of 26-30%, therefore, they had obvious disorders in the dentoalveolar system, which required selective orthodontic treatment. The proportion of such children in the group of 14-15 years old was lower - 18.0%, and among older students the value of the indicator was 14.0% and was statistically significantly less ($p<0.05$) than in the younger age group.

The value of the DAI index at the level of 31-35 was found in 4% of children aged 14-15 years and in 6% of cases in the examined 17-18 years old, while in the younger age group no one had a value of this indicator in this range. At the same time, in 6.0% of children aged 11-12 years, the DAI level exceeded 6.0%, which indicated an extreme need for orthodontic treatment. There were no such cases in the group of 14-15-year-old, in the older age group the proportion of such subjects was 2.0%.

An analysis of the distribution of children by levels of the DAI index depending on gender showed that the need for orthodontic treatment was more marked in boys of all age groups (Table 4).

With age, the value of this indicator in girls tended to decrease. Thus, in the group of 14-15-year-old girls, the proportion of persons with a DAI level of less than 25 was 83.3%, with a level of 26-30 - 10.0%, the values of the indicators were slightly lower than in the age group of 11-12 years.

Table 4.

Distribution of the surveyed depending on gender by the value of total value of DAI index (%).

Value of the DAI	11-12 years		14-15 years		17-18 years	
	Girls (n=86)	Boys (n=58)	Girls (n=50)	Boys (n=32)	Girls (n=115)	Boys (n=120)
≤25	70,0	55,0	83,3	70,0	84,9	64,7
26-30	26,7	35,0	10,0	30,0	15,1	11,8
31-35	-	-	6,7	-	-	17,7
≥36	3,3	10,0	-	-	-	5,8

The proportion of boys with a DAI value over 31 in the group of 11-12 years old was 10.0%, then at 14-15 years old - 6.7%, and in 17-18-year old it increased, amounting to a total of 23.5%, of which 17.7% of the level of this indicator was in the range of 31-35, 5.8% - over 36. That is, these children showed an extremely high degree of need for orthodontic intervention.

Discussion

The data obtained are consistent with the results of other authors. So, *Anokhina A.V., Khabibullina L.F.* (2016) studied the state of the dental system in 240 schoolchildren aged 12-15 years in Kazan, Russia. The authors showed that almost 50% of students needed orthodontic treatment (47.1%). At the same time, anomalies of the dentition were recorded in the first place in terms of frequency (46.9%), the frequency of detection of anomalies of occlusion of the dentition was 45.1%. The average value of the DAI index for schoolchildren with anomalies of occlusion was 33.12±0.63, and for those with anomalies of teeth and dentition – 27.18±0.45 [1].

In the work of *Vedovello S.A. et al.* (2019), which focused on assessing the need for orthodontic treatment using the DAI and the Index of Orthodontic Treatment Need (IOTN). The study was conducted on a representative random sample (n=5248) of adolescents aged 12 years. The authors showed that the proportion of adolescents with a high degree of dental-jaw anomalies and the need for orthodontic treatment was 10.5%, 36.5% and 73.4% for the aesthetic component of the IOTN index, the dental component of IOTN and DAI, respectively [20].

According to results of *Bagnenko N.M. et al.* (2016), obtained during the examination of children in the Leningrad region, dental anomalies occur in 88.8% of children, however, according to the DAI index, only 54.5% of those examined needed orthodontic treatment. At the same time, the authors indicate that the majority of children belong to the II period of mixed dentition (10-13 years). It is at this age that the second stage of active growth of the bones of the facial part of the skull takes place, which inevitably leads to an increase in the proportion of dentoalveolar anomalies of the skeletal type, in which the need for orthodontic treatment is much higher than in such mild forms, such as, for example, anomalies in the position of individual teeth. Young people at this age are already beginning to make increased demands both on their appearance and on the appearance of the schoolchildren around them. At the same time, the authors showed that the overall frequency of dental anomalies decreases due to ongoing processes of self-regulation with relatively adequately provided orthodontic care in the region and correction of mild forms using removable orthodontic equipment, as well as the elimination of three, diastemas and a number of other pathologies as a permanent occlusion is formed [2].

According to the authors, in order to reduce the unreasonably high volume of the load on the orthodontic treatment and preventive institutions of the optimization of financial spending, it is recommended to introduce into the practice of orthodontists a technique for identifying the need for orthodontic treatment of children through objective indices [2].

We agree with the opinion of *Grebnev G.A. et al.* (2015), who believe that with adequate organization of orthodontic care, including the use of objective indices, it is possible to significantly reduce the number of patients in need of this type of treatment [4].

Conclusions

The adolescents in socially unprotected groups have a high prevalence of dentoalveolar anomalies in Almaty and Almaty region.

It has been established that up to 30% of 12-year-olds and 32% of 18-year-old children from socially vulnerable groups in the surveyed regions of Kazakhstan need orthodontic care.

The severity of the identified dentoalveolar anomalies and their significant frequency among schoolchildren aged 12–15 years necessitate the optimization of orthodontic treatment methods and individualization of approaches when prescribing removable and / or non-removable orthodontic equipment, considering the incomplete growth and development of the dentofacial region in this age period.

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Conflict of interests

The authors confirm that there is no conflict of interest.

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