PROSPERITAS VESTRA FINIS NOSTRA!

Medical university - Varna
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Faculty of Dental medicine
Department of Pediatric dentistry

ORAL MANIFESTATION IN CHILDREN WITH AUTISM AND SOME SYNDROMES

ABSTRACT

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The dissertation contains 216 standard pages and is illustrated with 37 tables, 26 graphs, 15 figures and 6 appendices. The literary reference includes 399 literary sources, of which 33 are in Cyrillic and 366 are in Latin.

The dissertation work was discussed and directed for defense to the departmental council of the Department of "Pediatric Dentistry" at the Medical University "Prof. Dr. Paraskev Stoyanov" - Varna on February 28, 2023.

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The official defense of the dissertation work will take place on 29.05.2023. from ___ o'clock in the Faculty of Dental Medicine - Varna at an open meeting of the Scientific Jury.
The defense materials are available in the Scientific Department of the Medical University-Varna and are published on the website of the Medical University-Varna.
Note: In the abstract, the numbers of the tables and figures do not correspond to the numbers in the dissertation work.

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ABBREVIATIONS USED

ОА – обща анестезия

РАС – разстройства от аутистичния спектър

СОП – специални образователни потребности

СЗО – Световна здравна организация

СЗП – Специфични здравни потребности

ССР – Синдром на Силвър-Ръсел

ASD – Autism spectrum disorder

DS – Down syndrome

SHCN – Special health care needs

SRS – Silver-Russell syndrome

TSD – Tell-Show-Do

I. INTRODUCTION

According to data from the World Health Organization (WHO), worldwide more than 15% of the population lives with disabilities, and 5.1% of them are children, of which 0.7% are severely disabled. In Bulgaria, the estimated number of children with disabilities is over 32,000, although there is a lack of detailed information on their exact number, and in recent years the institutions have directed their efforts to creating a favorable learning environment and integrating them into general education kindergartens and schools. Oral health is a very important aspect of general health, especially for vulnerable groups such as children with specific health needs. The demand for dental treatment for patients with intellectual disabilities, physical limitations, social and emotional deficits is also increasing. This requires a broad view of the dental practitioner, which often leads to a multidisciplinary approach. (301) However, many professionals still find it challenging to provide better treatment. This is largely due to lack of proper professional training, insecurity, ergonomic limitations, etc. (122, 212) Children with intellectual disabilities exhibit insecure emotional behavior and restlessness with a short attention span; Therefore, it is essential to reduce anxiety by establishing proper dentist-patient-parent relationships for adequate implementation of dental prophylaxis and treatment of the child. Furthermore, these children may not understand, take responsibility for, or cooperate with preventive oral health practices. The sooner help is sought from a dentist, the lower the risk of developing oral complications that can affect the child's overall health. The pathogenesis of oral diseases in these children can be very extensive, and their knowledge by the attending physicians can help to implement multifactorial treatment and improve their standard of living. Providing comprehensive and adequate information to help dentists and parents in the oral health care of these children is the subject of scientific interest of many researchers worldwide.

PERSONAL RESEARCH

III. AIM AND OBJECTIVES

The purpose of this scientific study is to investigate the oral status in children with autism and some syndromes, and the treatment-prophylactic approach to these children.

The purpose of the dissertation can be fulfilled by solving the following objectives:

1. Assessment of oral hygiene status and frequency of dental caries in children with autism and some rare syndromes.

2. Assessment of gingival and periodontal status in children with autism and some rare syndromes.

3. Assessment of orthodontic status and dental anomalies in children with autism and some rare syndromes.

4. Assessment of the awareness of dentists and parents of children with autism and some syndromes and preparation of updated protocols and motivational materials for the prevention and treatment of children's oral diseases.

Hypotheses:

1. It is assumed that children with autism and some syndromes have a higher DMFT index than healthy children.

2. It is assumed that children with autism and some syndromes have a more severe periodontal status than healthy children.

3. It is assumed that children with autism and some syndromes have a more severe orthodontic status than healthy children.

4. It is assumed that parents of children with autism and some syndromes are not informed about their oral health.

IV. MATERIALS AND METHODS

1. **Materials**

For the purposes of this dissertation, the oral profile of children with autism, Down syndrome, Silver-Russell syndrome and healthy children was investigated according to gender, age, hygiene habits, eating habits and behavior. All children were examined clinically and evaluated according to various indicators.

The units of the study are 240 children aged 3-18 years from Varna region, who were admitted to the University Medical and Dental Center of FDM-Varna for primary examination, control examination, prophylactic examination or treatment for a period of 2 years. Patients were divided into four groups.

• 60 children with autism spectrum disorders (19 girls and 41 boys)

• 60 children with Down syndrome (33 girls and 27 boys)

• 60 children with Silver-Russell syndrome (31 girls and 29 boys). Children with Silver-Russell syndrome participate in a growth hormone treatment program at the Expert Center for Rare Endocrine Diseases at Sveta Marina UMBAL, Varna, with the head of the center Prof. Dr. Violeta Yotova, MD. and were sent for dental and orthodontic treatment in UMDC at FDM Varna.

• 60 healthy children (control) (36 girls and 24 boys)

Patients were selected based on the following criteria:

a) Inclusion criteria

- Children aged 3 and under 18 at the date of visit;
- Children without systemic diseases for the healthy 60 children;
- Children with Down syndrome, Silver-Russell syndrome or autism;
- Children whose guardians have filled out a declaration of informed consent and expressed a desire to participate in the study.

b) Exclusion criteria

- Children under 3 and over 18 years of age on the date of visit
- Children with systemic diseases for the healthy group
- Children whose parents or guardians did not fill out a declaration of informed consent and did not express a desire to participate in the study

Anamnesis was taken from all participants in the study and a dental examination was conducted, which included a study of the prevalence of dental caries, oral hygiene status, gingival, periodontal status and orthodontic status. The status was registered by the lead researcher in individual outpatient records from UMDC-Varna (Appendix 3). The anamnesis is taken according to the data of the child's parents. The children's parents signed an informed consent form (Appendix 2) after being read information about the current study (Appendix 1).

1.1 **For the implementation of the first objective** - *To investigate the oral hygiene status and the frequency of dental caries in children with autism and some syndromes:*

• Object of observation - Frequency of dental caries, oral hygiene status

• Units of observation - 240 children who meet the criteria for inclusion in the study.

• Signs of monitoring: Frequency of dental caries by the DMF index (T+t) with diagnostic threshold D1a, activity of carious lesions. To register the oral hygiene status, carbohydrate nutrition, oral hygiene (frequency of brushing teeth, frequency of brushing teeth per day, duration of brushing teeth, participation of parents in performing oral hygiene) fluoride prophylaxis (individual or professional applied), frequency of dental office visits, Silness&Loe simplified plaque index (PI).

• Study period: 2020-2022 incl.

• Place of the study: University Medical and Dental Center of FDM-Varna at MU-Varna

1.2 **For the implementation of the second objective** - *Assessment of gingival and periodontal status in children with autism and some rare syndromes:*

• Subject of the study: gingival and periodontal status

• Units of observation: 240 children who meet the criteria for inclusion in the study.

• Monitoring signs: Loe&Silness simplified gingival index, PSR index, probing depth

• Study period: 2020-2022 incl.

• Place of study: University Medical-Dental Center of FDM-Varna at MU-Varna

1.3 **For the implementation of the third objective** - *Assessment of orthodontic status and dental anomalies in children with autism and some rare syndromes:*

• Object of the study: Orthodontic status and the presence of dental anomalies

• Units of observation: 240 children who meet the criteria for inclusion in the study.

• Signs of observation: Angle class, Petrunov classification for assessment of severity of deformities.

• Study period: 2020-2022 incl.

• Place of the study: University Medical and Dental Center of FDM-Varna at MU-Varna

1.4 **For the implementation of the fourth objective** - *Researching the awareness of parents and dentists and preparing a critical analysis based on current research and existing protocols for the prevention and treatment of children with autism and some syndromes.*

• Object of observation: Awareness of parents of children with autism and syndromes and of dentists

• Observation units are 180 parents and 60 dentists who give written consent to participate in the study

• Signs of observation: questionnaire survey – questions included in original, direct survey cards that are distributed electronically or in paper form (Appendices 4 and 5)

• Study period: 2020-2022 incl.

• Place of the study: University Medical and Dental Center of FDM-Varna at MU-Varna

2. **Methods**

2.1 Objective 1: **To investigate the oral hygiene status and the frequency of dental caries in children with autism and some syndromes:**

A detailed ambulatory sheet is filled out for each patient (Appendix 3). It includes a passport part with information on name, age, gender and registration of frequency of dental caries, activity of carious lesions, carbohydrate intake, oral hygiene (an assessment is also made of children's oral hygiene habits, their oral hygiene skills , tools used, time allocated and participation of parents), fluoride prophylaxis – individually or professionally applied, frequency of visits to a dental office.

The simplified Silness & Loe plaque index (PI) is used to assess oral hygiene status. (229) This index measures plaque thickness in the gingival third of tooth crowns. With a dental mirror and a probe, the gingival areas of the four surfaces of teeth 16,22,24,36,42,44 are examined - medial, distal, vestibular and lingual under directed lighting and after drying the tooth surfaces. In the absence of the described teeth, their temporary equivalents are used - 55,52,64,65,72,84. Plaque thickness reading is done by pushing the tip of the probe along the surface of the tooth to the coronal sulcus. The result of the corresponding tooth is the sum of the surface scores divided by four. Visible plaque on at least one surface is recorded as '1' and its absence is indicated as '0'. The resulting value after calculation determines the level of oral hygiene of the specific patient and is entered in his outpatient card. In children with autism, a modified Silness&Loe index is used, in which the vestibular surface is evaluated only at 13(53), 12(52), 11(51), 21(61), 22(62), 23(63). (9)

PI

0 – no plaque

1 – thin plaque around the gingival margin, visible only after scraping with a probe

2 – average amount of plaque visible to the naked eye

3 – a large amount of plaque around the gingival margin and in the interdental spaces

The following rating scale was used to determine the level of oral hygiene:

PI<0.1 is considered excellent, 0.1-0.9 – good, 1-1.9 – acceptable, 2-3 – bad.

The examination and registration of the dental status is done by the D1MF(T+t) index and assessment of the initial carious lesions with an initial diagnostic threshold d1/D1. This index is calculated based on conducting a clinical examination. (124) Diagnosed the earliest, reversible, stage d1/D1 and d2/D2 enamel carious lesions using clear criteria, visual observation under directed light, cleaning and drying. Irreversible, cavitated, dentine carious lesions in stage d3/D3 and those with complicated caries in stage d4/D4 are also diagnosed. Carious, missing due to caries or its complication (m/M) and obturated teeth (f/F) are reflected. Due to the age of some of the patients with mixed dentition and the period of active physiological change, only the teeth that were extracted due to complicated caries, dysplasia or fracture are noted. The assessment is carried out by examining all caries-prone places: cervix; fissures and approximal surfaces.

Examinations are carried out in a dental office on a professional dental chair with directed light, water and air. Observation is done with a dental mirror only, and a probe is not used to determine the depth of the defects and to check the roughness or texture of any of the observed lesions, as irreversible damage may be done to the already demineralized enamel or with the use of a periodontal probe with an atraumatic tip.

Examinations are performed in a clinical setting and in appropriate lighting, with sterile kits for each child and disposable gloves. The data obtained from each patient are entered in the outpatient card.

Criteria for an active lesion:
- in predisposed places and located under plaque
- change in color (whitish, white or chalky)
- loss of shine
- loss of smoothness
- lack of clear boundaries with healthy enamel
- located under the plaque
- loss of transparency

Criteria for a localized lesion:
- limited sizes
- clear boundaries of healthy enamel
- color from white to brown or black
- absence of plaque
- located in non-predisposed places for the development of caries. (15)

2.2 Objective 2 - **Assessment of gingival and periodontal status in children with autism and some rare syndromes.**

2.2.1. The evaluation of the gingival inflammation of the children from the studied groups was realized using the simplified gingival index (GI according to Loe&Silness). (228) The registered data are entered in the patient's outpatient record (Appendix 3). This index measures the prevalence of gingival inflammation and is based on a visual assessment of the presence or absence of gingival inflammation. Bleeding is assessed by careful probing along the soft tissue wall of the

gingival sulcus. It is measured on 6 teeth (16,12,24,36,32,44), and if they are not available on their temporary equivalents (55,52,64,65,72,84). It is measured for the vestibular, medial, distal and lingual surfaces. The results from the four areas of the tooth can be summed and divided by four to give the GI for the tooth. An individual's GI can be obtained by adding the values of each tooth and dividing by the number of teeth examined. The marginal gingiva and interdental papilla are examined with codes from 0 to 3.

A score of 0.1-1.0 = mild inflammation 1.1-2.0 = moderate inflammation of and 2.1-3.0 means severe inflammation The index value is calculated by summing the recorded values around all teeth and divide by their number. (228) Each vestibular, lingual, medial, and distal tooth surface is coded from 0 to 3.

code 0 – absence of clinical symptoms

code 1 – initial changes in gingival color and surface without bleeding on gentle probing are assessed

code 2 – redness, swelling and bleeding of the gingiva on gentle probing

code 3 – significant redness, swelling with a tendency to spontaneous bleeding

The score for each tooth is the arithmetic mean result of the four tooth surfaces, and the patient's score is obtained from the mean arithmetic result of the examined teeth**.**

2.2.2. The PSR index is used to record the periodontal status. (54) With WHO 621 probe weighing 20-25g, with a 0.5mm spherical ball at the tip and a black stripe at 3.5-5.5mm. The dentition is divided into 6 sextants – 16 (55), 11(51), 26(65), 36(75), 31(71), 46(85). The probe is inserted at 6 points around each tooth. For each tooth, the highest value is recorded, which is decisive for each sextant. The results are calculated according to the following table:

Code 0 – The probe does not penetrate to the black mark, there is no bleeding and no plaque

Code 1 – The probe does not penetrate to the black mark, but there is bleeding

Code 2 – The probe has not yet penetrated the black mark, but there is bleeding, plaque and tartar

Code 3 - The probe enters the center of the mark - pocket 4-5 mm, there is bleeding, plaque, calculus

Code 4 – The entire mark sinks into the pocket which reaches >6mm

2.2.3. In teeth with registered code 3 and 4, it is said to be an inflammatory-destructive disease - periodontitis, and probing depths were measured for each tooth. Probing depth (DS) is the distance from the margo gingivalis to the bottom of the sulcus or pocket, measured in mm with a periodontal probe. The probe is inserted into the pocket parallel to the longitudinal axis of the tooth without losing contact with the tooth surface until resistance is felt from the bottom of the sulcus/periodontal pocket. After its introduction into the pocket, the probe advances with a step of 1 mm and an up-down amplitude of 1-2 mm, to identify the depth of the pocket for each area, and when the probe is raised for the next step, it does not completely exit the pocket. Pockets deeper than 4 mm may indicate periodontitis. The vestibular and oral surfaces are examined sequentially. In the ambulatory chart, the highest measured value is recorded, three for each tooth surface - vestibular and oral respectively, and for this purpose they are divided into three fields each, respectively - medially, distally and in the middle zone of the vestibular / oral surface. Thus, six values are recorded for each tooth. According to the measured values for each tooth, the diagnosis for the corresponding periodontal unit is determined, and to characterize the general periodontal status for the corresponding patient, the arithmetic mean value of the probing depth from all the examined locations is calculated.

2.3 Objective 3 - **Assessment of orthodontic status and dental abnormalities in children with autism and some rare syndromes.**

2.3.1 To assess the orthodontic status, the examined teeth are in the individual dental arch and in occlusion, as well as radiographs. Angle classification was used. (24) According to the orthodontic status, children are divided into 3 groups - according to Angle.

Class I according to Angle – normal medio-distal relations in the area of the molars, and the deviations affect only the frontal teeth

Class II according to Angle - includes all deformities in which a distal position of the lower first molars is observed, with protrusion of the frontal teeth (II1) or a specific position of the incisors - retrusion of the central and protrusion of the lateral incisors-(II2).

Class III according to Angle - all deformities are included, in which there is a medial location of the lower first permanent molars compared to the upper ones and a crossbite of the frontal teeth. (24)

The means of determining whether hypodontia is present include clinical and radiographic examination. Clinical examination includes assessment of malocclusion according to Angle's classification of malocclusion based on anterior-posterior relationships. X-ray examination is done if the clinical examination is not sufficient to determine if hypodontia is present. The criteria for hypodontia are met if the tooth is not in the dental arch, if it cannot be seen on a radiograph, and if there is no previous history of its extraction or expulsion.

Orthodontic status was recorded in accordance with the Petrunov classification for assessing the severity of deformities and the need for treatment, according to which there are 6 degrees. (25) The frequency of hypodontia or oligodontia of permanent teeth was also investigated in children with 5 degrees of deformity.

I degree – no deformity or very slight deformity

1.a. Deviations in the position of the teeth, but not more than 3 teeth with presence of diastema and treme

II degree – slight deformity

2.a. Deviations in the position of the teeth, but no more than 3 teeth without the presence of diastema and treme

2. b. Persistent temporary tooth after the eruption of the permanent one

2. c. Prematurely extracted temporary tooth or early loss of permanent tooth without loss of space

2. year Distal bite of 1/3 to 1/2 measurement unit in mixed dentition

2.e. Scar bite

2.e. Same-name tubercle or crossbite of temporary teeth in the lateral section

III degree – moderately severe deformity

3.a. Deviations in the position of 4 or more frontal teeth with a lack of space, less than one lateral incisor

3. b. Prematurely extracted temporary tooth or early loss of permanent tooth with loss of space

3. c. Hyperodontia - mesiodens

3. year Macrodontia 16

3. e. Diastema over 3mm

3.e. Distal bite of 1/2 to 1 measurement unit in mixed and 1/3 to 1/2 in permanent dentition

3.g. Medial bite of 1/3 to 1/2 measurement unit

3. h. Overjet from 3 to 6 mm

3.i. Crossbite up to two front teeth with space available

3.k. Divergence of the incisal points to 1/2 of the width of a lower incisor

3.l. Same name tubercle bite of at least 2 pairs of antagonists - permanent teeth

3. m. Unilateral crossbite in the lateral region of more than two pairs of antagonists without deviation in the movement of the lower jaw

3.n. Deep bite covering 2/3 of the crown of the lower incisor

3. Fr. Open bite in the front up to 1mm 3.p. Open bite in the lateral region to two pairs of antagonists unilaterally

IV degree – severe deformity

4.a. Deviations in the position of 4 or more frontal teeth with insufficient space for one or more lateral incisors

4. b. Hypodontia of single teeth

4. c. Hyperodontia other than mesiodens or multiple hyperodontia

4.g. Distal bite over 1 unit of measurement in mixed and 1/2 to 1 in permanent dentition

4.e. Medial bite of 1/2 to 1 unit of measurement

4.f. Overjet from 6 to 9 mm 4.g. Crossbite of all frontal teeth or of single teeth without available space 17

4. h. Divergence of the incisal points more than 1/2 of the width of the lower incisor

4.i. A cross or dissimilar tubercle bite of two or more pairs of antagonists on each side

4.k. Unilateral crossbite, lingual or buccal bite with mandibular displacement

4.l. Deep bite covering the entire crown of the lower incisor, without soft tissue trauma

4. m. Open bite in the front from 1 to 3 mm

4.n. Open bite in the lateral region of up to 2 pairs of antagonists on each side

V degree - very severe deformity

5.a. Multiple hypodontia

5. b. Medial bite over 1 unit of measurement

5. c. Distal bite over 1 measurement unit in permanent dentition

5.g. Tie over 9mm

5.e. Crossbite with spacing of all front teeth

5.e. Lingual or buccal bite on all lateral teeth

5.g. Deep bite with soft tissue trauma

5. h. Open bite in the front over 3mm

5.i. Open bite in the lateral region of 3 or more pairs of antagonists on each side

5. k. Ankylosed (sunk) temporary tooth

5.l. Retained tooth (permanent dentition only)

VI degree – very severe deformity and anomaly for complex treatment

6.a. Congenital clefts

6. b. Severe dento-jaw deformities and anomalies, as an element of a syndrome. (25)

2.4 Objective 4 - **To examine the awareness of parents and dentists and to make a critical analysis based on the information received and the existing protocols for the prevention and treatment of children with autism and some syndromes.**

For the implementation of task 4, two surveys were conducted with questionnaires that are filled in by the parents of children with autism and some syndromes and dental doctors anonymously, with the aim of collecting information about their awareness of children's oral health, as well as about available methods and means of prevention and treatment. The survey consists of two 10-question surveys. Surveys for dentists are distributed in electronic version, and surveys for children's parents are distributed in paper version on the territory of the Medical-Dental Center at the Faculty of Dental Medicine.

Based on the data obtained from the surveys and the summarized results of the research, protocols for the prevention and treatment of children with autism and some syndromes have been prepared, the purpose of which is to update the already existing ones in our and world literature. Informative and motivational materials have been prepared for patients and their parents regarding nutrition, oral hygiene, fluoride prophylaxis and dental office visits. Materials have also been created that aim to help dental doctors to successfully conduct prophylaxis and treatment of these patients in outpatient settings. (Appendix 5, 6A, 6B, 6C)

Statistical methods - systematization and summarization of statistical data. The statistical processing of the data helps to interpret the derived statistical quantities with a view to revealing the essence of the observed phenomena. If a quantitative assessment is impossible, a qualitative analysis is applied.

• Analysis of variance (ANOVA) - for comparison of quantifiable normally distributed indicators in more than two groups;

• Variation analysis - when describing quantitative indicators - arithmetic mean ± standard deviation (mean ± SD);

• Correlation analysis – to study the relationship between observed phenomena. Pearson's coefficient and Spearman's coefficient were used

• Comparative analysis (hypothesis evaluation) - χ^2, F and t-test.

• Graphical and tabular method of displaying the results. An acceptable level of significance of the null hypothesis $p<0.05$ is accepted.

Statistical processing of the data was performed using the SPSS v.20.0 software product.

Ethical considerations

The protocols of the studies were approved by KENI, MU Varna. All parents were asked to sign an informed consent form after being provided with detailed information by the principal investigator. The participation of all persons in the study is voluntary. For children under 14 years of age, participation in the study was subject to parental consent, while for children over 14 years of age, consent to participate was obtained from both the parents and the patient. (Appendix 1 and Appendix 2)

V. RESULTS AND DISCUSSIONS

Results on objective 1

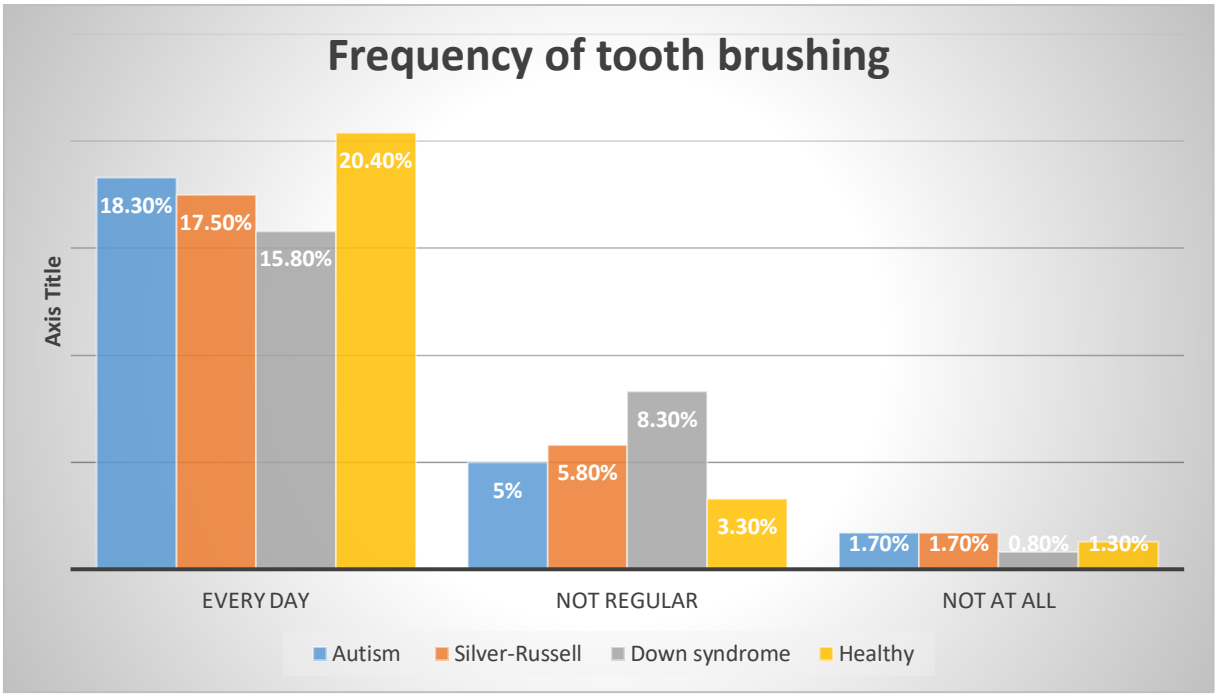
The gender distribution of the examined children and adolescents in children with autism was 53.3% for girls and 46.7% for boys. In children with Down syndrome, 33 girls (55%) and 27 boys (45%) were examined. There is also a slight preponderance in the distribution in children with Silver-Russell syndrome (51% girls and 49% boys) as well as in healthy controls (58.3% girls and 41.7% boys). The average age of the children included in the study was 8.63 years for children with autism, 8.55 years for children with Silver-Russell syndrome, 9.13 years for children with Down syndrome, and 8.95 years for healthy controls. The minimum age of the examined children is 3 years, and the maximum is 16 years.

Assessment of oral hygiene status in children with autism and some syndromes.

To assess the oral hygiene status of children with autism and some syndromes, oral hygiene and eating habits were examined in the present scientific work, which were then compared with those of healthy children.

In order to check whether there are statistically significant differences between the criteria for the individual groups of children, the Chi Square Test is applied. According to the first indicator, frequency of tooth brushing, **no significant difference** was found between the individual studied groups. The basis for this is given by the characteristic (**χ^2= 7.853, p=0.249**). Of all the children examined, 72.1% brush their teeth every day, 22.5% brush their teeth irregularly and 5.4% do not brush their teeth at all. Of the children who brushed their teeth every day, 18.3% were children with autism, 17.5% were children with Silver-Russell syndrome, 15.8% were children with Down syndrome, and 20.4% were healthy children. Of the children who do not practice regular oral hygiene, 5% are children with autism, 5.8% are children with Silver-Russell syndrome, 8.3% are children with Down syndrome, and 3.3% are healthy children. The least are the children who do not perform oral hygiene, as 1.7% are children with autism, 1.7% are children with Silver-Russell syndrome, 0.8% are children with Down syndrome and 1.3% are healthy children.

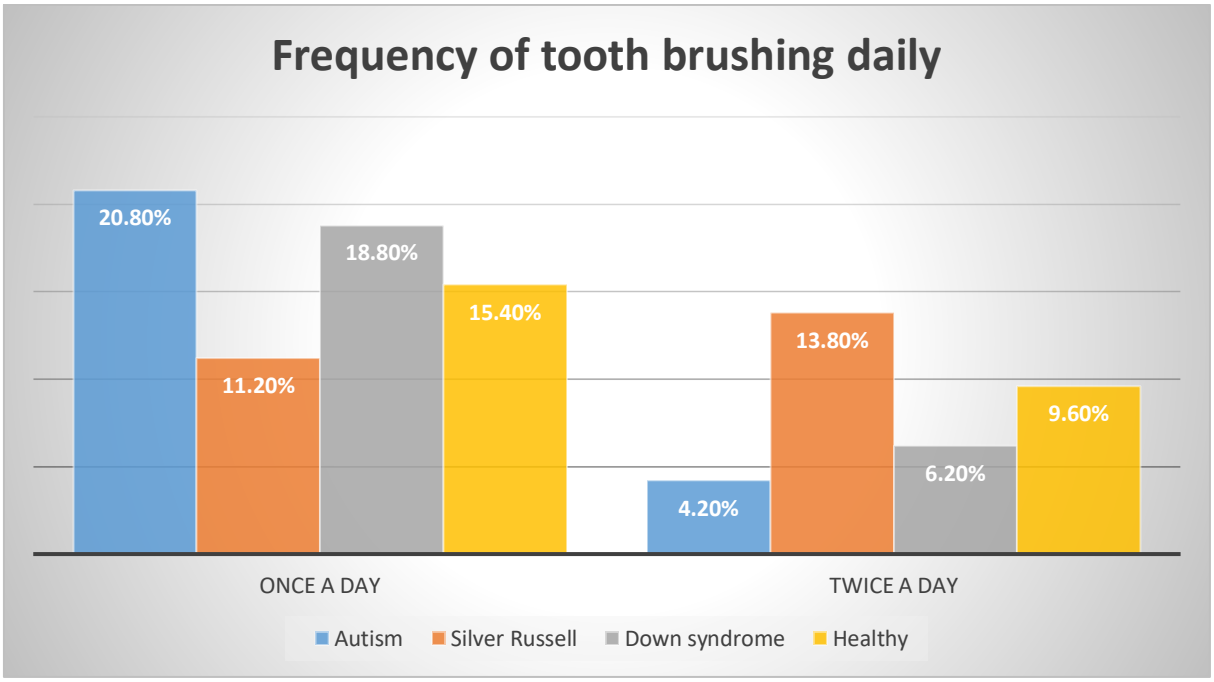
This distribution is shown in the following graph. (Graph 1)



Graph 1. Distribution of children according to frequency of tooth brushing.

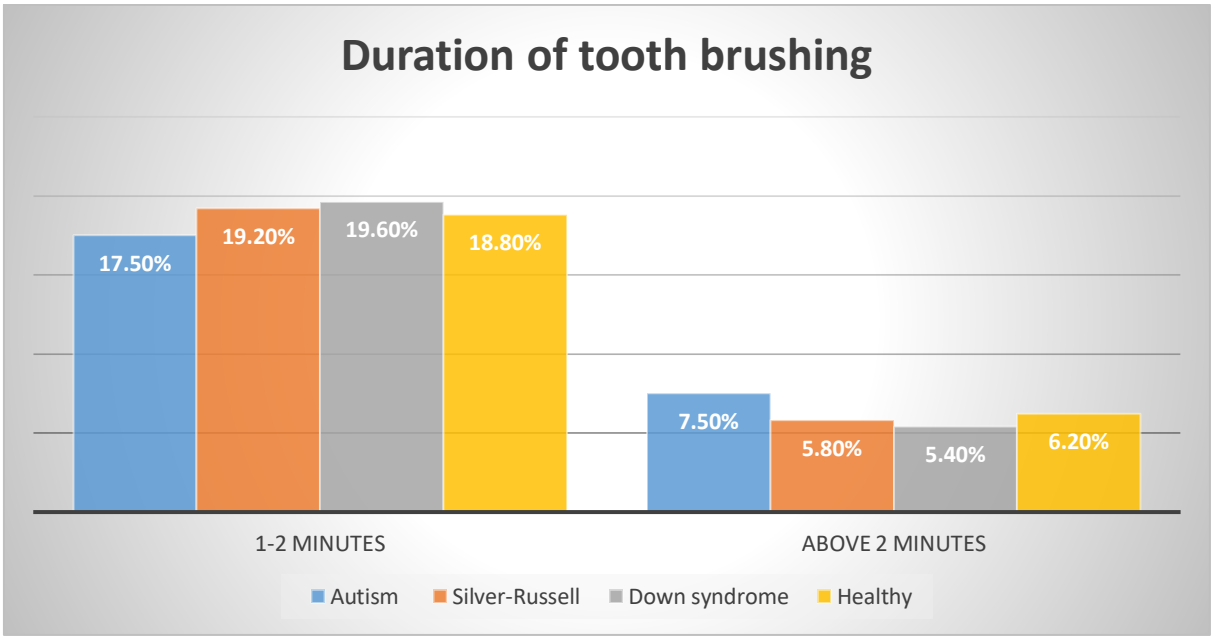
According to the characteristic frequency of brushing teeth per day, **there is a significant difference** shown by the characteristic $\chi^2 = 22.567$, for which the level of significance is $p<0.001$. The strength of the relationship is determined by Cramer's coefficient V = 0.307. This coefficient is statistically significant because it is greater than 0.3 and less than 0.5, indicating that there is a **moderate correlation** between the groups and the frequency of brushing teeth each day.

According to the indicator frequency of brushing teeth per day, a total of 159 children with a relative share of 66.2% brush their teeth once a day, and 81 children (33.8%) - twice a day. Of all children in the study, 20.8% of children with autism brushed their teeth once a day, followed by 18.8% of children with Down syndrome, 15.4% of healthy children and 11.2% of children with Silver syndrome - Russell. Of the percentage of children who brush their teeth twice a day, 4.2% are children with autism, 13.8% are children with Silver-Russell syndrome, 6.2% are children with Down syndrome, and 9.6% are healthy children. The results are presented in Graph 2.



Graph 2. Distribution of children according to the frequency of brushing their teeth per day

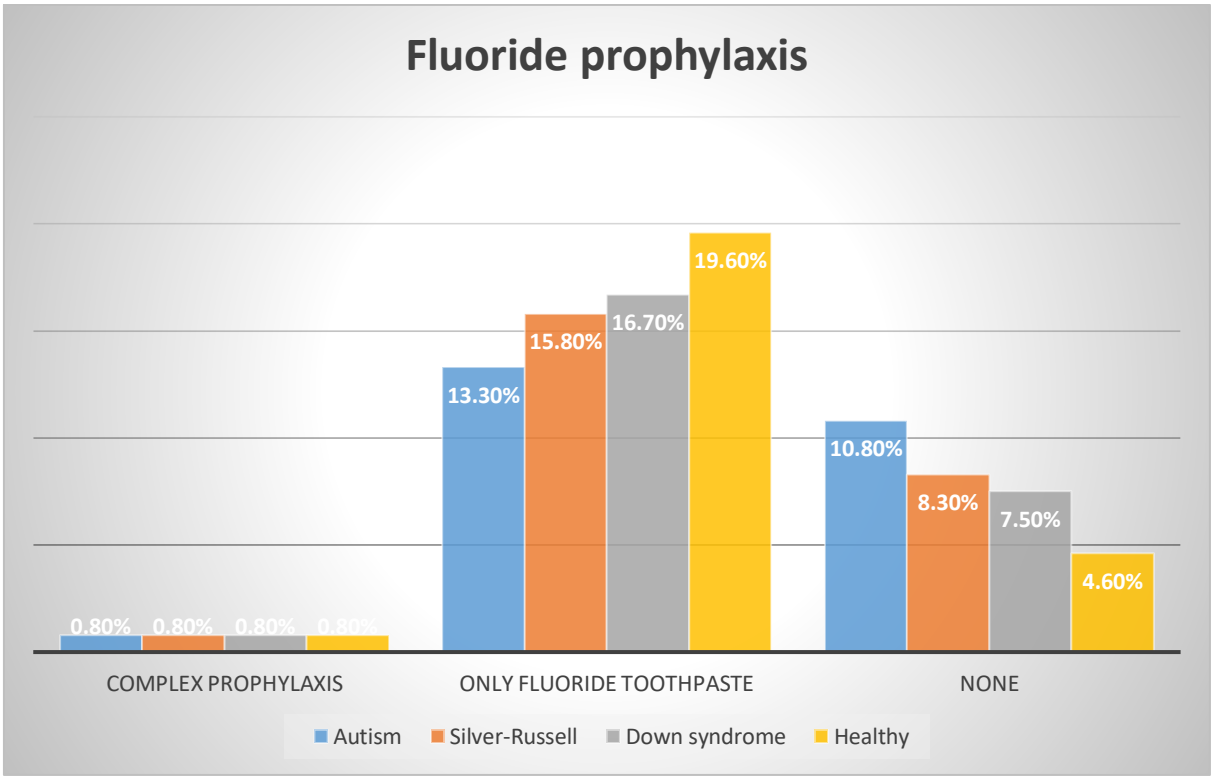
According to the third characteristic - duration of tooth brushing, **no significant difference was observed** between the four studied groups. The basis for this is given by the characteristic (χ^2 **= 1.244, p = 0.742**). A total of 180 children (75.0%) brush their teeth for 1-2 minutes, while the remaining 60 (25.0%) brush their teeth for more than 2 minutes. Of the children who brush their teeth for 1-2 minutes, 17.5% are autistic, 19.2% are children with Silver-Russell syndrome, 19.6% are children with Down syndrome and 18.8% are healthy. children. 7.5% of children with autism were found to brush their teeth for more than 2 minutes, followed by 6.2% of healthy children, 5.8% of children with Silver-Russell syndrome and 5.4% of children with of Down. The results are shown in Graph 3.



Graph 3. Distribution of children according to the duration of tooth brushing

The examination of fluoride prophylaxis in the examined children **did not show a significant difference**, and in all the examined groups the use of only fluoride toothpaste was preferred. The basis for this is given by the characteristic $\chi^2 = 9.044$, **p=0.171**. The fluoride prophylaxis of the majority of 157 children with a relative share of 65.4% consists of brushing the teeth only with fluoride paste. Of these children, 32 (13.3%) were children with autism, 38 (15.8%) were children with Silver-Russell syndrome, 16.7% were children with Down syndrome, and 19.6% were healthy children.

Of the total number of children, 75 (31.4%) do not use fluoride prophylaxis at all. Of these, 26 children (10.8%) were children with autism, 8.3% were children with Silver-Russell syndrome, 7.5% were children with Down syndrome, and 4.6% were healthy children.Only 8 children – 2 from each group use complex prophylaxis. The results are shown in Graph 4.



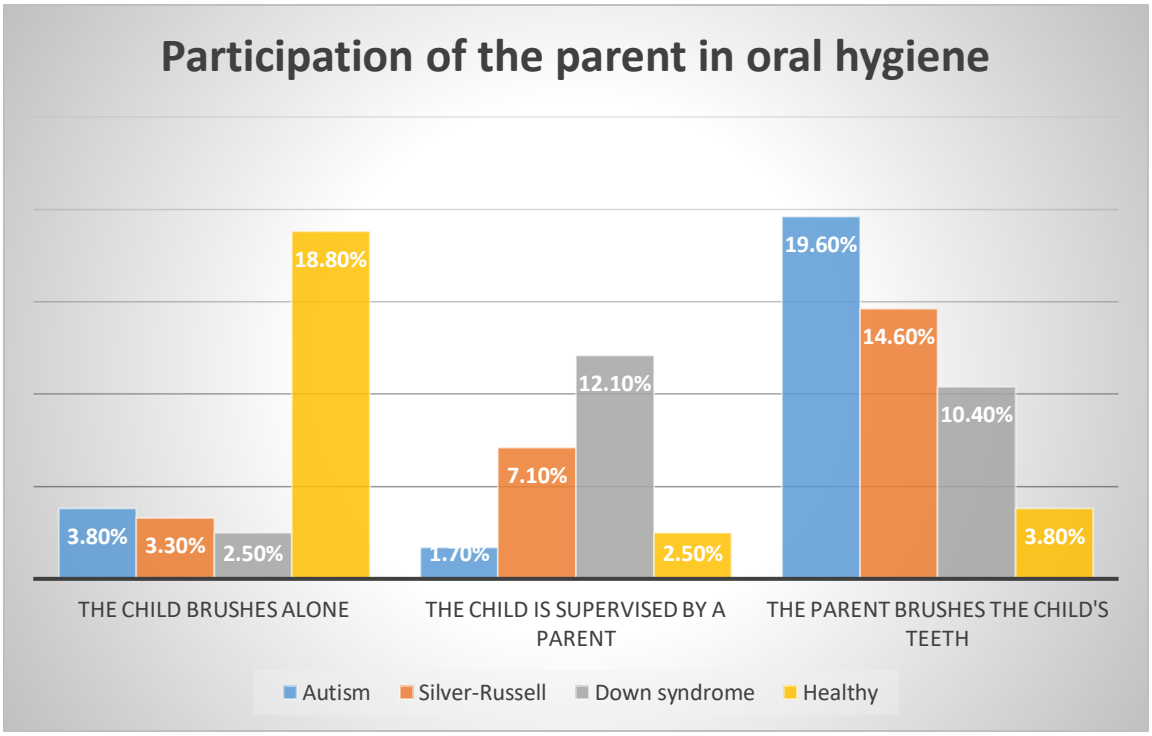
Graph 4. Distribution of children according to the use of fluoride prophylaxis

From the conducted research, it is clear that in children with autism and syndromes, parents are the ones who perform the child's oral hygiene in a higher percentage.

The result is statistically significant. The basis for this is given by the characteristic $\chi^2 = 116.952$, $p < 0.001$.

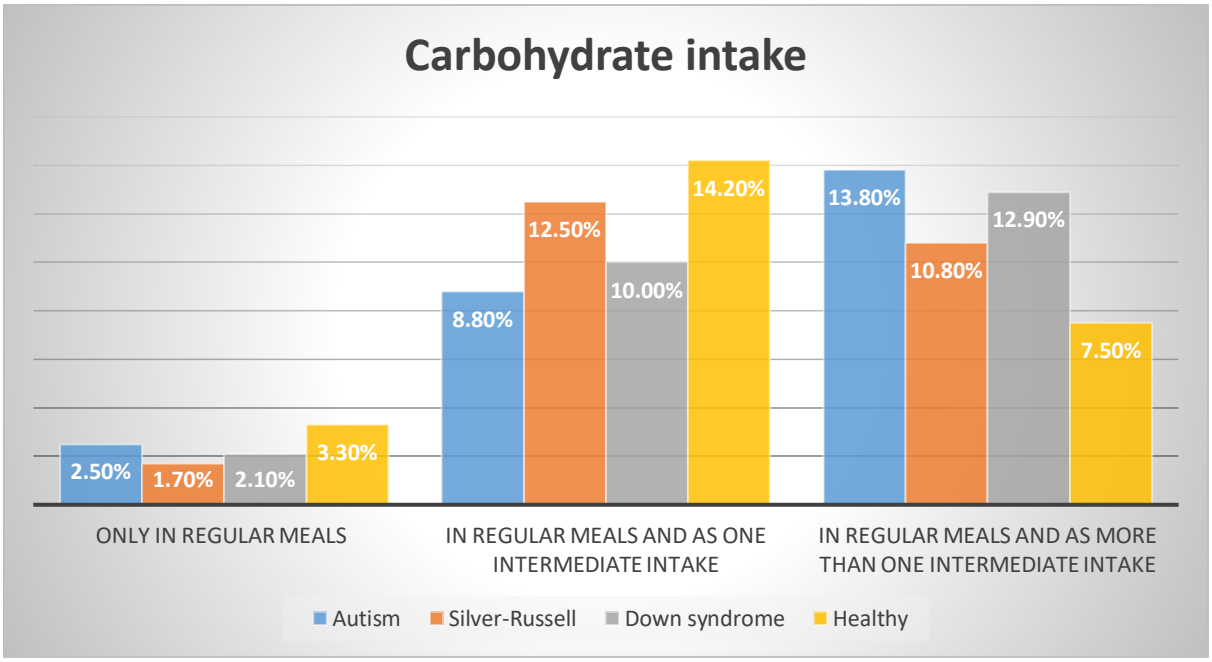
The strength of the relationship is determined by Cramer's coefficient V = 0.494. This coefficient is statistically significant because it is greater than 0.3 and less than 0.5, indicating that there is a moderate correlation between the groups and the parent's involvement in the child's OC. Out of a total of 240 children, in 116 with a relative share of 48.3%, the parent brushes the child's teeth. Of these, 47 (19.6% of the total number of children) were children with autism, 14.6% were children with Silver-Russell syndrome, 10.4% were children with Down syndrome, and 3.8% were healthy children. In 4 children with autism (1.7%), 17 children with Silver-Russell syndrome (7.1%), 29 children with Down syndrome (12.1%) and 6 healthy children (2.9%), oral hygiene is carried out under the supervision of the parent. In the highest percentage of all children, 18.8% of healthy children brush their teeth alone, followed

by 3.8% of children with autism, 3.3% of children with Silver-Russell syndrome and 2.5% of children with Down syndrome. The results are presented in Graph 5.



Graph 5. Distribution of children according to the parent's participation in the performance of oral hygiene.

The study of carbohydrate nutrition shows a greater frequency of carbohydrate food intake as intermediate meals in all studied groups of children. **No statistically significant value was observed** between groups. The basis for this is given by the characteristic $\chi^2 = 10.255$, **p= 0.114**. This analysis showed that of a total of 240 children, 109 (45.4%) consumed carbohydrates as a main meal and as a snack. Of these, 8.8% were children with autism, 12.5% were children with Silver-Russell syndrome, 10% were children with Down syndrome, and 14.2% were healthy children. Only during the main meal, 23 children (9.6%) take carbohydrates, of which 2.5% with autism, 1.7% with Silver-Russell syndrome, 2.1% - children with Down syndrome and 3, 3% healthy children. With more than one intermediate meal per day are 108 of the children (45%), of which 13.8% are children with autism, 10.8% are children with Silver-Russell syndrome, 12.9% for children with Down and 7.5% are healthy children. The results are presented in Graph 6.

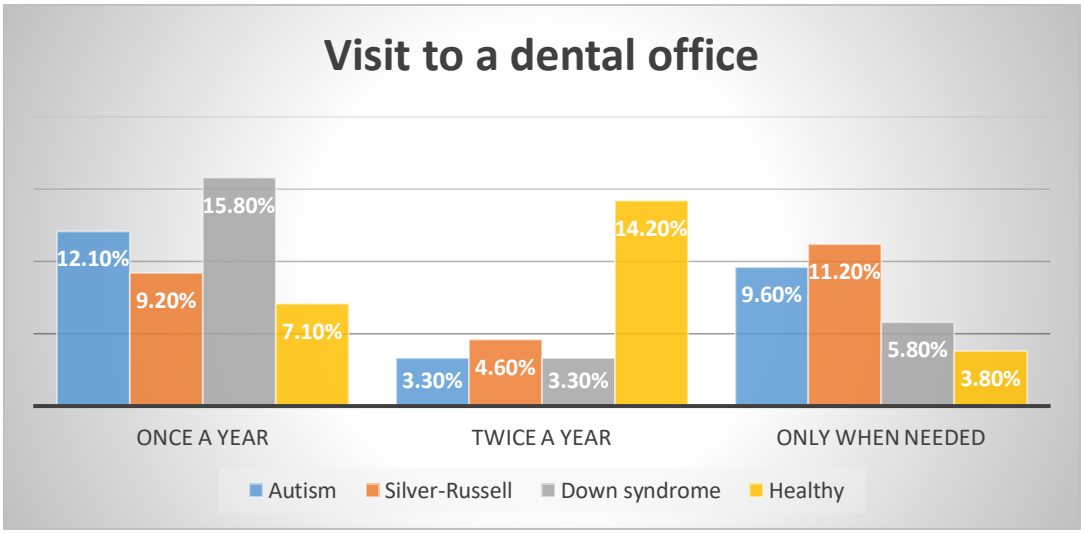


Graph 6. The distribution of the frequency of carbohydrate meals in the examined children.

A statistically significant difference was found between the groups when comparing the frequency of dental visits. Healthy children visit a dentist twice a year in a higher percentage compared to the other studied groups. The characteristic $\chi^2 = 51.637$, **$p<0.001$.** The strength of the relationship is determined by Cramer's coefficient V = 0.328 (moderate correlation).

Out of a total of 240 children participating in the study, 106 with a relative share of 44.2% visit a dentist once a year. Of these, 12.1% were children with autism, 9.2% were children with Silver-Russell syndrome, 15.8% were children with Down syndrome, and 7.1% were healthy children. A significantly smaller number of the examined children visit a dentist twice a year - 61 (25.4%). Of these, 3.3% were children with autism, 4.6% were children with Silver-Russell syndrome, 3.3% were children with Down syndrome, and 14.2% were healthy children.

Of the examined children, 73 visit a dentist only when necessary, which is 30.4% of all children. Of these, 9.6% have autism, 11.2% have Silver-Russell syndrome, 5.8% have Down syndrome, and 3.8% are healthy children. The results are shown in Graph 7.



Graph 7. The distribution of the frequency of visits to a dentist among the examined children.

An examination of plaque index and incidence of dental caries

After analyzing the ambulatory charts, the mean values of Silness&Loe's CI were determined. The group of children with Down syndrome had the highest average value of the PI Silness-Loe indicator – 2.40±0.72. In second place is the group of children with autism - 1.23±0.58, in third place are healthy children - 1.47±0.65, and with the smallest value is the group of children with Silver-Russell syndrome – 0.89±0.52. (Table 1)

Table 1. Mean PI values of the studied groups of patients

Indicator	*Group 1 Children with autism*	*Group 2 Children with SRS*	*Group 3 Children with DS*	*Group 4 Healthy children*
PI Silness-Loe	1,23±0,58	0,89±0,52	2,40±0,72	1,47±0,65

In the examined children with autism, the average value of the plaque index was 1.23±0.58, which corresponds to acceptable oral hygiene. Table 2 presents the average values of PI for individual age groups, with the highest index value of 1.75±0.62 reported in children with autism over 12 years of age, followed by children of school age – 1.15±0 ,48, with the least plaque accumulation and the best oral hygiene found for children under 6 years of age.

Increasing PI value is evidence of deterioration of oral hygiene with age in children with autism. In children with autism, for the PI indicator, the differences between the mean values by age groups were statistically significant (**F=9.390, p<0.001**).

Table 2. Descriptive statistics of PI by age groups in children with autism

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PI Silness-Loe	<6 years	17	0,9724	0,46571	0,11295	0,7329	1,2118	0,17	1,83
	6-12y.	30	1,1517	0,48625	0,08878	0,9701	1,3332	0,33	2,33
	>12 years	13	1,7592	0,62634	0,17372	1,3807	2,1377	0,83	3,00
	Total	60	1,2325	0,58205	0,07514	1,0821	1,3829	0,17	3,00

In the studied children with Silver-Russell syndrome, the average value of the plaque index was 0.89±0.52, which corresponds to good oral hygiene. Table 3 presents the average values of PI for individual age groups, with the highest index value of 1.41±0.77 reported in children with CP syndrome over 12 years of age, followed by children of school age – 0.80 ±0.33, with children under 6 having the least plaque build-up and the best oral hygiene. Increasing PI value is evidence of deterioration of oral hygiene with age in children with CP syndrome. In children with Silver-Russell syndrome, for the PI indicator, the differences between the mean values by age groups were statistically significant (**F=7.902, p=0.001**).

Table 3. Descriptive statistics of PI by age groups in children with Silver-Russell syndrome

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PI Silness-Loe	<6 years	16	0,7213	0,48283	0,12071	0,4640	,9785	,08	1,70
	6-12 y.	34	0,8084	0,33218	0,05697	0,6925	,9243	,25	2,00
	>12 years	10	1,4190	0,77551	0,24524	,8642	1,9738	,58	2,70
	Total	60	0,8869	0,52126	0,06729	,7523	1,0216	,08	2,70

In the studied children with Down syndrome, the average value of the plaque index was 2.40±0.72, which corresponds to poor oral hygiene. Table 4 presents the average values of PI for individual age groups, with the highest index value of 2.80±0.41 reported in children with Down syndrome over 12 years of age, followed by children of school age – 2.40 ±0.72, and for children under 6 years of age, the least plaque accumulation and acceptable oral hygiene were found - 1.81±0.73. Increasing PI value is evidence of deterioration of oral hygiene with age in children with Down syndrome. In children with Down syndrome, for the PI indicator, the differences between the mean values by age groups were statistically significant (**F=5.009, p=0.009**).

Table 4. Descriptive statistics of PI by age group in children with Down syndrome

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PI Silness-Loe	<6 years	8	1,8100	0,73436	0,25964	1,1961	2,4239	0,96	2,71
	6-12y.	40	2,4000	0,72746	0,11502	2,1673	2,6327	0,65	3,00
	>12 years	12	2,8000	0,41348	0,11936	2,5373	3,0627	1,70	3,00
	Total	60	2,4013	0,72485	0,09358	2,2141	2,5886	0,65	3,00

In healthy children, the mean plaque index value was 1.47±0.65, which corresponds to acceptable oral hygiene. Table 5 presents the average values of PI for individual age groups, with the highest index value of 2.20±0.44 recorded in children over 12 years old, followed by children of school age – 1.40±0.45 , and the least plaque accumulation and good oral hygiene were found for children under 6 years of age - 0.9±0.47. Increasing PI value is evidence of deterioration of oral hygiene with age in children. For the PI indicator in healthy children, the differences between the mean values by age groups were statistically significant (**F=31.615, p<0.001**).

Table 5. Descriptive statistics of PI by age groups in healthy children

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
PI Silness-Loe	< 6 years	15	0,9000	0,47246	0,12199	0,6384	1,1616	0,33	2,33
	6-12y.	30	1,4000	0,44922	0,08202	1,2323	1,5677	0,58	2,20
	>12 years	15	2,2000	0,44346	0,11450	1,9544	2,4456	1,42	3,00
	Total	60	1,4750	0,64759	0,08360	1,3077	1,6423	0,33	3,00

To study the frequency of dental caries in children with autism and some rare syndromes, variational statistical analysis was applied. After analyzing the data from the outpatient charts, it became clear that the prevalence of dmft caries in the group of children with autism was the highest with a value of 4.92±2.06, in children with Silver Russell it ranked second with 4.55± 1.86, third in the control group with 4.14±1.38 and the smallest value was observed in children with Down syndrome – 2.77±1.29. The obtained results are presented in Table 6 for the four groups of children.

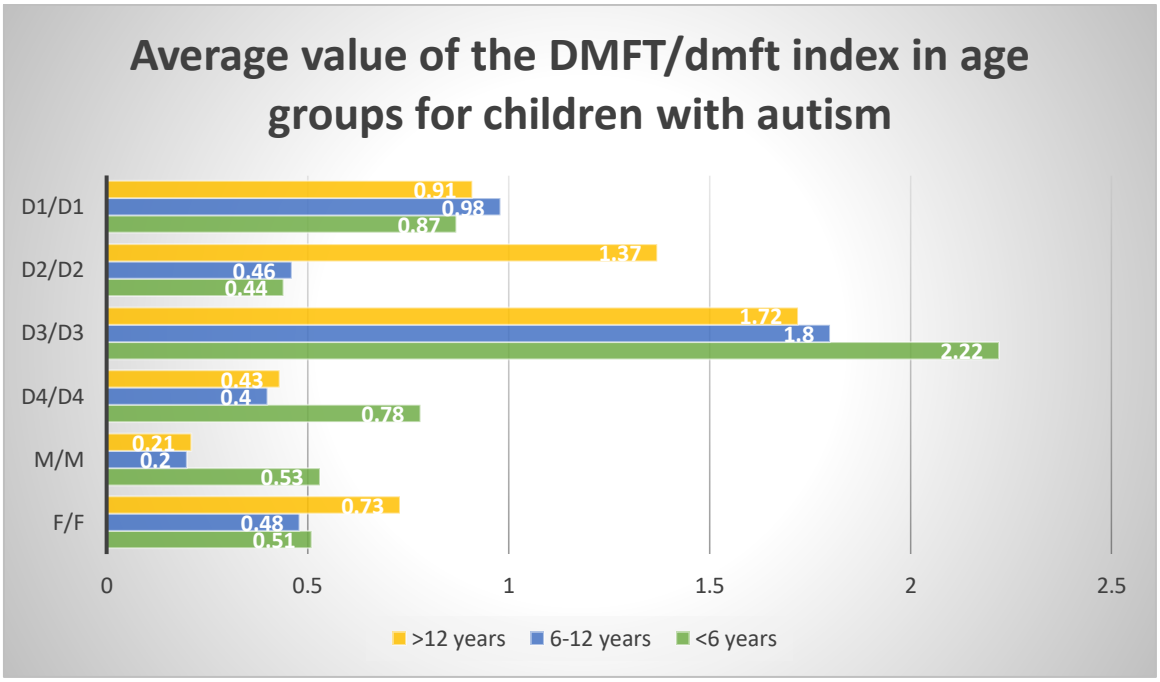
Table 6. Average values of the DMFT index in the studied groups of children.

Indicator	*Group 1 Children with autism*	*Group 2 Children with SRS*	*Group 3 Children with DS*	*Group 4 Healthy children*
d1/D1	0,93±0,78	0,58±0,68	0,51±0,73	0,63±0,87
d2/D2	0,65±0,87	0,49±0,82	0,27±0,42	0,85±0,92
d3/D3	1,91±1,29	1,93±1,19	0,81±0,74	1,37±0,74
d4/D4	0,51±0,49	0,43±0,45	0,54±0,59	0,28±0,37
m/M	0,29±0,59	0,19±0,39	0,13±0,35	0,21±0,47
f/F	0,54±0,72	0,91±0,73	0,54±0,55	0,99±0,99
dmft/ dmf(T+t)/ DMFT	4,92±2,06	4,55±1,86	2,77±1,29	4,14±1,38

In children with autism, the highest prevalence of D3 carious lesions was observed in children of all age groups, with the highest prevalence in children under 6 years of age – 2.22±1.81. In this age group, the lowest prevalence of obturated teeth was observed - 0.51±0.42, due to difficulty in performing dental treatment in these patients. D1/d1 lesions were most common in children aged 6-12 years with 0.98±0.61, followed by children >12 years with 0.91±0.8, and least common in children under < 6 years – 0.87±1.05. D2/d2 lesions were most common in children >12 years with 0.73±0.70. D4/d4 lesions were most common in children <6 years with 0.78±0.61. The results of the ANOVA test show that for the indicators d2/D2 and d4/D4 the differences between the average values for the three age groups **are statistically significant**.

For **D2 - F = 6.594, p= 0.003**. The prevalence of these lesions is highest in the age group >12 years – 0.73±0.70

For the **d4 - F = 3.923, p = 0.025**. The prevalence of these lesions is highest in the age group <6 years – 0.78±0.61. (Graph 8)



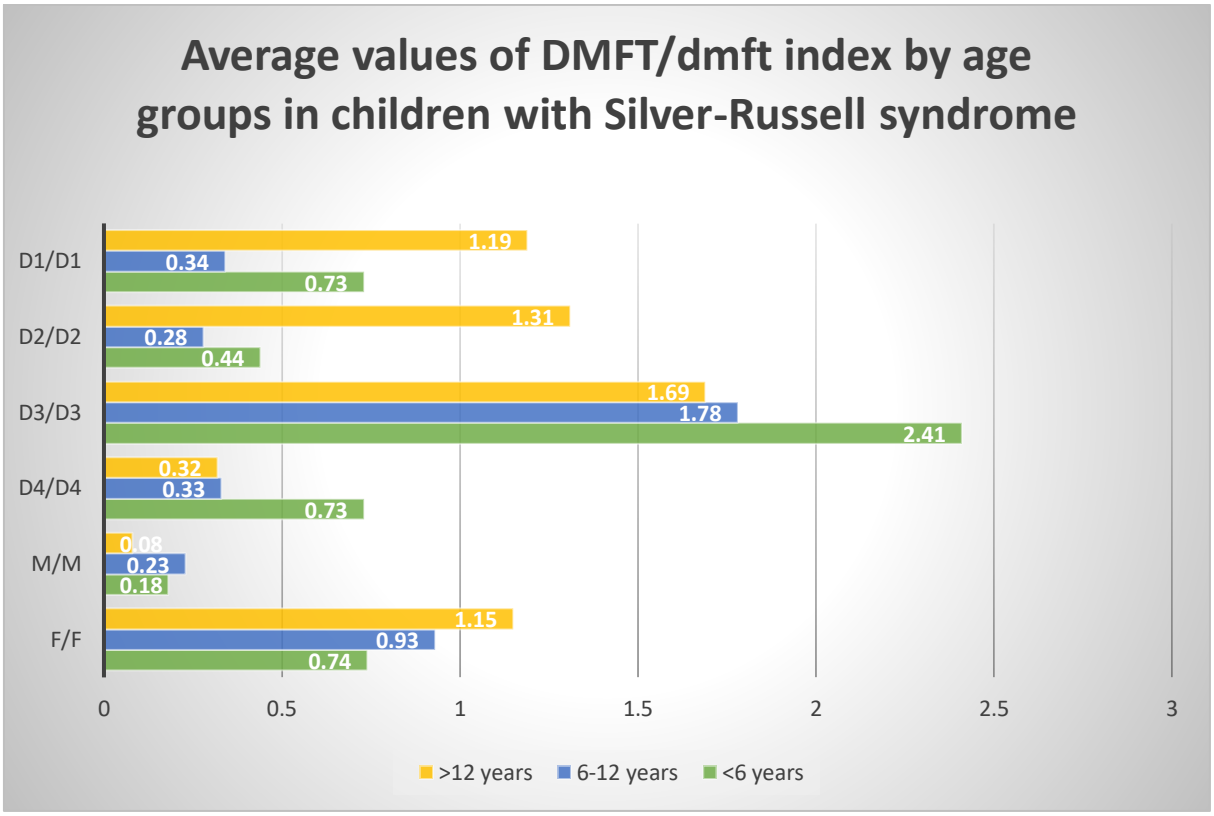
Graph 8. Average values of DMFT/dmft index by age groups in children with autism

In children with Silver-Russell syndrome, the highest prevalence of d1/D1 lesions was observed in the group of children >12 years with 1.19±0.63, and this was also observed for d2/D2 lesions – 1.31± 1.58. Dentinal lesions d3/D3 and complicated carious lesions d4/D4 are most common in the group of children <6 years, and this group ranks last in obturated teeth among the three age groups with Silver-Russell syndrome - 0.74±0 ,88. The results of the ANOVA test show that for the indicators d1/D1, d2/D2 and d4/D4 the differences between the mean values **are statistically significant.**

For D1 - F = 8.132, p=0.001. The prevalence of these lesions is highest in the age group >12 years – 1.19±0.63.

For D2 - F = 7.325, p=0.001. The prevalence of these lesions is highest in the age group >12 years – 1.31±1.58.

For d4 - F = 5.343 p=0.007. The prevalence of these lesions is highest in the <6 years age group. The mean values of the DMFT index by age group in children with Silver-Russell syndrome are shown in Graph 9.



Graph 9. Average values of DMFT/dmft index by age groups in children with Silver-Russell syndrome

In children with Down syndrome, the highest prevalence of d3/D3 and d4/D4 lesions was observed in children of the <6 years group, as for d3/D3 – 1.87±1.25, and for d4/D4 lesions – 1.09±0.64. D1/D1 lesions are most common in the age group >12 years – 1.28±0.75. The least obturated teeth are observed in the age group <6 years – 0.12± 0.23. ANOVA test shows that for the indicators d1/D1, d2/D2, d3/D3 d4/D4 and f/F the differences between the average values for the three age groups **are statistically significant.**

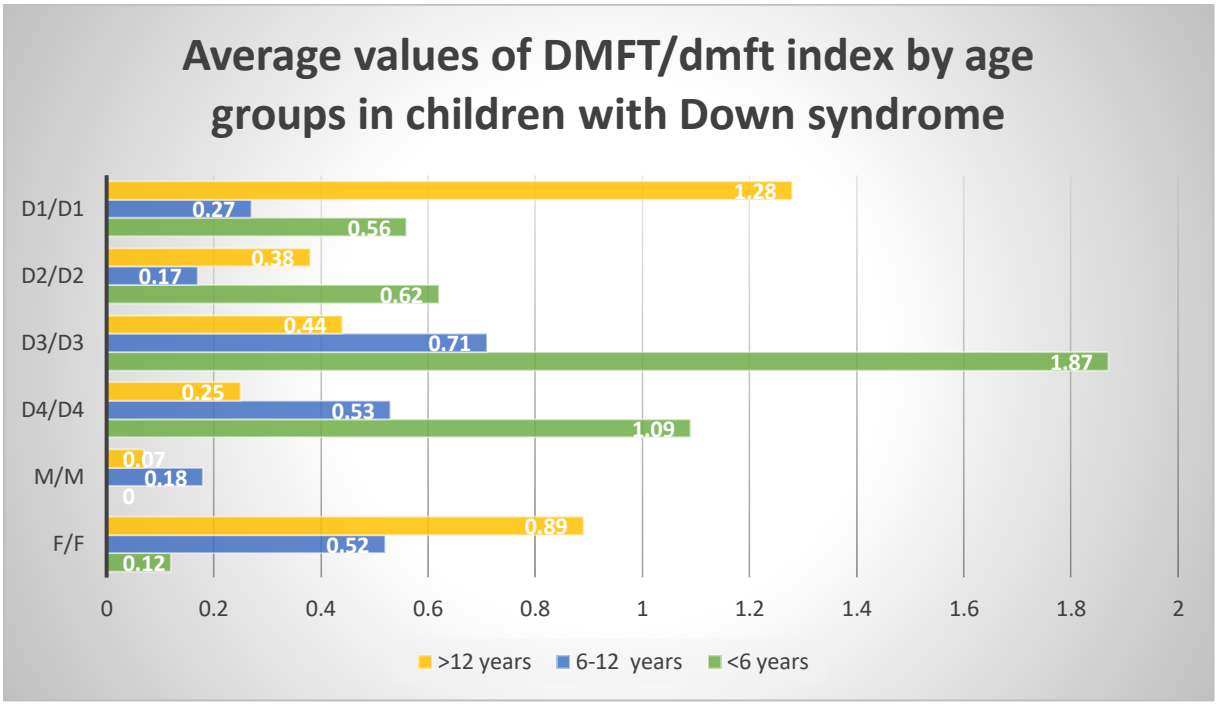
For D1 - F = 11.888, p<0.001. The prevalence of these lesions is highest in the age group >12 years – 1.28±0.75.

For d2/D2 - F = 4.866, p=0.011. The prevalence of these lesions is highest in the age group <6 years – 0.62±0.44.

For d3/D3 - F = 14.329 p<0.001. The prevalence of these lesions is highest in the age group <6 years – 1.87±1.25.

For d4/D4 - F = 5.494, p=0.007. The prevalence of these lesions was highest in the age group <6 years – 1.09±0.64.

For f/F - F = 5.439, p=0.007. The prevalence of obturated teeth is highest in the age group >12 years – 0.89±1.00. Average values by age group for children with Down syndrome are shown in Graph 10.



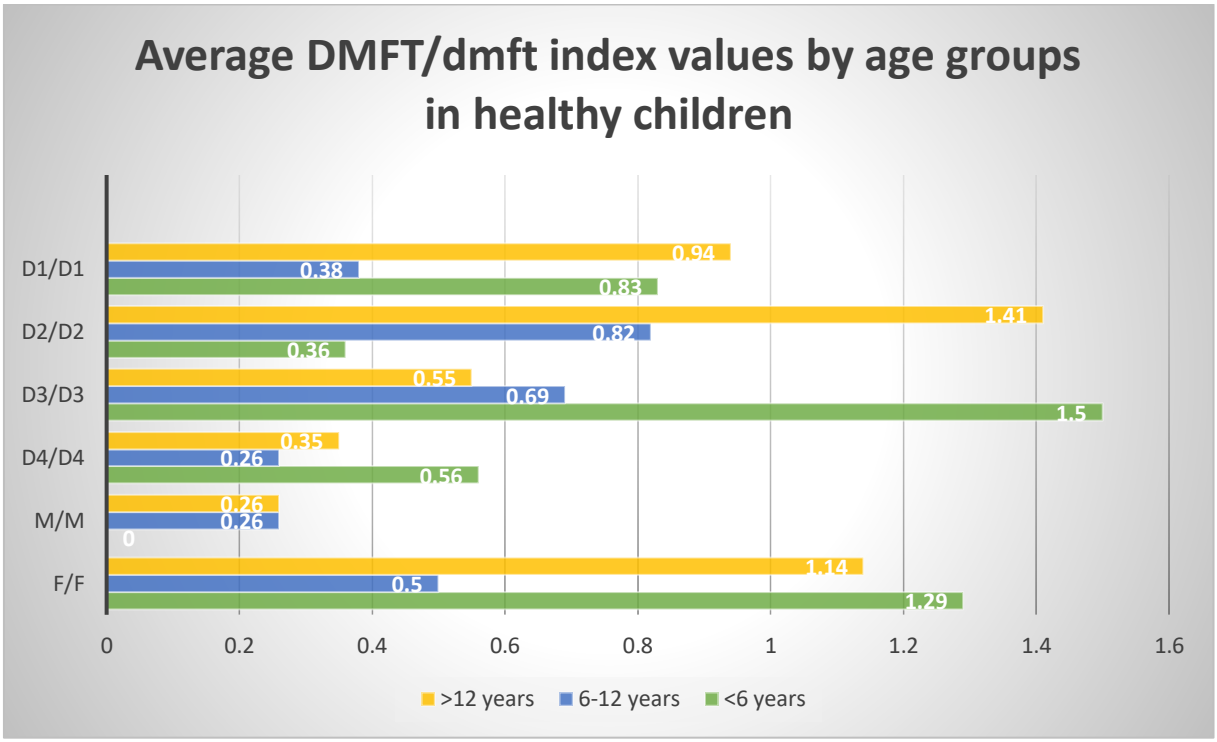
Graph 10. Average values of DMFT/dmft index by age groups in children with Down syndrome

In the group of healthy children, again the prevalence of lesions d1/D1- 0.94±1.21 and d2/D2- 1.41±0.84 was highest in the group of children >12 years. Dentinal lesions d3/D3- 1.50±0.93 and complicated carious lesions d4/D4 were observed most frequently in children <6 years. In the group of healthy children, higher results of obturated teeth f/F were also observed - 1.29±0.33 for the group of children <6 years and 1.14±0.30 for the group of children >12 years. ANOVA test shows that only for the indicators d2/D2 and f/F the differences between the average values for the three age groups **are statistically significant**.

For D2 - F = 5.667, p=0.006. The prevalence of these lesions is highest in the age group >12 years – 1.41±0.84.

For f/F - F = 5.478, p=0.007. The prevalence of obturated teeth is highest in the age group <6 years – 1.29±0.33.

The results are presented in Graph 11.



Graph 11. Average DMFT/dmft index values by age groups in healthy children

Discussion of objective 1

Oral health is a very important aspect of general health, especially for vulnerable groups such as children with special health needs. It is important to provide adequate oral care to promote quality of life and good health for all, especially children with special health needs. The lack of practice to maintain oral hygiene leads to the deterioration of oral health with a negative impact on the nutritional status, quality of life and overall condition of children. The results obtained by us for conducting oral hygiene once a day, lasting between 1-2 minutes in children with autism and syndromes, are also confirmed by other authors. (134, 300, 366) Parental involvement in oral hygiene was observed more often in children with autism and syndromes compared to healthy children, with them supervising or performing the action for the child. This again confirms the research of other authors. (43, 134, 356) Of all children, those who regularly visit a dentist are from the group of healthy children. Children with autism and syndromes visit a dentist when needed, including an emergency (pain or trauma) or once a year as part of a regular check-up. (90, 131,

156, 218, 351) Visiting the dentist in the early stages of development of the temporary teeth results in less need for treatment and fewer indications for treatment under general anesthesia. (207, 387) When examining the oral hygiene status of children, the highest values were observed in children with Down syndrome and autism. Maintaining oral hygiene is difficult in children with autism, involving training, motivation and remotivation to acquire proper oral hygiene habits. Children memorize the movements mechanically and in a short time, and also experience difficulties in the implementation in practice. (134) A higher plaque index was observed in children with Down syndrome compared to the control group, being highest in children aged 6-12 years. This is also confirmed by other authors. (166, 259) Children with Silver-Russell had a significantly low measured plaque index, and of the age groups studied, it was highest in the >12-year-old age group, where less parental involvement was observed in performing of oral hygiene. Autistic children also have a lower plaque index compared to healthy children because parents also largely perform or supervise their oral hygiene. (43) In the present study, it was found that the prevalence of carious lesions was highest in the group of children with autism, with type D3 lesions – dentinal caries being the most prevalent. This is confirmed by other works from recent years. (69, 190, 240) In Brazil, a study showed very high risks (86%) of caries related to poor oral hygiene and eating habits of children. (88) In a study by Hasell et.al, regarding dental caries, over 90% of children with ASD had a DMFT/dmft index score >1, while just under 66% of controls had a DMFT/dmft index score > 1. (177) This is also confirmed by our research. This is due to the strong affinity of these children for sweet carbohydrate foods, their tendency to retain food for a long time in the oral cavity before swallowing, which is combined with difficulty in performing oral hygiene of unsatisfactory quality. (137) Low values of the number of obturated teeth were studied. Studies in the world literature report that tooth extraction is preferred over tooth obturation. (269) Higher DMFT/dmft scores may also be due to parents focusing on other health and behavioral issues more than oral health, or a lack of education about successful behavior management strategies available in pediatric dental settings. clinics. (202) Our study confirms the lower prevalence of carious lesions in children with Down syndrome, which has been described in many works over the years. (8, 171, 221, 263, 299) This is due to the slower eruption of teeth, the presence of diastemas and treme, and the significantly higher content of sIgA in the saliva of children with Down syndrome. (8, 221) Areias et al. attributed the low incidence of caries to the fact that the teeth of DS patients erupted later, therefore being exposed to cariogenic factors for a shorter period. This study also looked at bruxism

in children with Down syndrome, which smoothes occlusal surfaces due to tooth friction, leading to better self-cleaning and caries prevention. (61) Scalioni et al. looked at fluorescent in situ hybridization (FISH) quantified cariogenic bacteria in the saliva of children and adolescents with DS compared to healthy controls. They found that children and adolescents with DS had lower densities of S. mutans and higher densities of Streptococcus sobrinus, the latter being associated with caries development, particularly on smooth surfaces. (60, 331)

Results for objective 2

After analyzing the ambulatory charts, the average values of the Loe & Silness gingival index in the studied groups were determined.

The group of children with Down syndrome had the highest average value of the GI Loe-Silness indicator – 1.51±0.64. In second place is the group of children with autism - 0.74±0.66, in third place are healthy children - 0.89±0.58, and with the smallest value is the group of children with Silver-Russell syndrome - 0.70±0.49. They are presented in Table 7.

Table 7. Mean GI values of the studied groups of patients

Indicator	*Group 1 Children with autism*	*Group 2 Children with SRS*	*Group 3 Children with DS*	*Group 4 Healthy children*
GI Loe-Silness	0,74±0,66	0,70±0,49	1,51±0,64	0,89±0,58

In children with autism, the highest gingival index was observed in the group of children >12 years of age – 1.55±0.69, which corresponds to moderate inflammation, followed by the group of children 6-12 years of age – 0.63±0, 48 and the lowest in children <6 years – 0.31±0.24, in which mild inflammation of the gingiva was observed. The results are presented in Table 8.

Table 8. Descriptive statistics by age group for children with autism

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
GI Loe-Silness	<6 years	17	,3182	,24120	,05850	,1942	,4422	,00	,83
	6-12 y.	30	,6303	,48222	,08804	,4503	,8104	,00	1,83
	>12 years	13	1,5531	,69150	,19179	1,1352	1,9709	,50	3,00
	Total	60	,7418	,65602	,08469	,5724	,9113	,00	3,00

ANOVA test shows that for the GI Loe-Silness indicator the differences between the mean values for the three age groups are statistically significant. For GI Loe-Silness F = 25.454, p<0.001.

In children with Silver-Russell syndrome, the highest gingival index was observed again in the group of children >12 years of age - 1.22±0.62 with moderate gingival inflammation, followed by the group of children 6-12 years of age - 0.67 ±0.32 and the lowest in children <6 years – 0.41±0.43, with low gingival inflammation. The results are presented in Table 9.

Table 9. Descriptive statistics by age group in children with Silver-Russell syndrome

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
GI Loe-Silness	<6 years	16	0,4122	0,43934	0,10984	,1781	,6463	,00	1,70
	6-12 y.	34	0,6772	0,32293	0,05538	,5645	,7899	,16	1,83
	>12 years	10	1,2260	0,62939	0,19903	,7758	1,6762	,50	2,50
	Total	60	0,6980	0,48732	0,06291	,5721	,8239	,00	2,50

In children with Silver-Russell syndrome, the differences between the average values of the GI index by age groups were **statistically significant - F = 11.828, p<0.001**

In children with Down syndrome, severe inflammation was observed in the group of children >12 years – 1.63±0.76. Moderate inflammation was observed in the group of children 6-12 years - 1.49±0.64 and in the group of children <6 years - 1.39±0.51. The results are shown in Table 27.

Table 27. Descriptive statistics by age group in children with Down syndrome

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
GI Loe-Silness	< 6 years	8	1,3981	0,51467	0,18196	0,9679	1,8284	0,75	2,20
	6-12 y.	40	1,4984	0,64104	0,10136	1,2934	1,7034	0,16	2,79
	> 12 years	12	1,6358	0,76179	0,21991	1,1518	2,1198	0,67	2,70
	Total	60	1,5125	0,64518	0,08329	1,3458	1,6792	0,16	2,79

In children with Down syndrome, the differences between the average values for the GI by age groups **were not statistically significant - F = 0.347, p=0.708**.

In healthy children, the gingival index is the highest in the group of children over 12 years old - 1.32±0.53 with moderate gingival inflammation, in the group of children 6-12 years old the index shows lower values - 0.95±0 .49, and the lowest are in the group of children <6 years – 0.35±0.31, with slight gingival inflammation observed. The results are shown in Table 10.

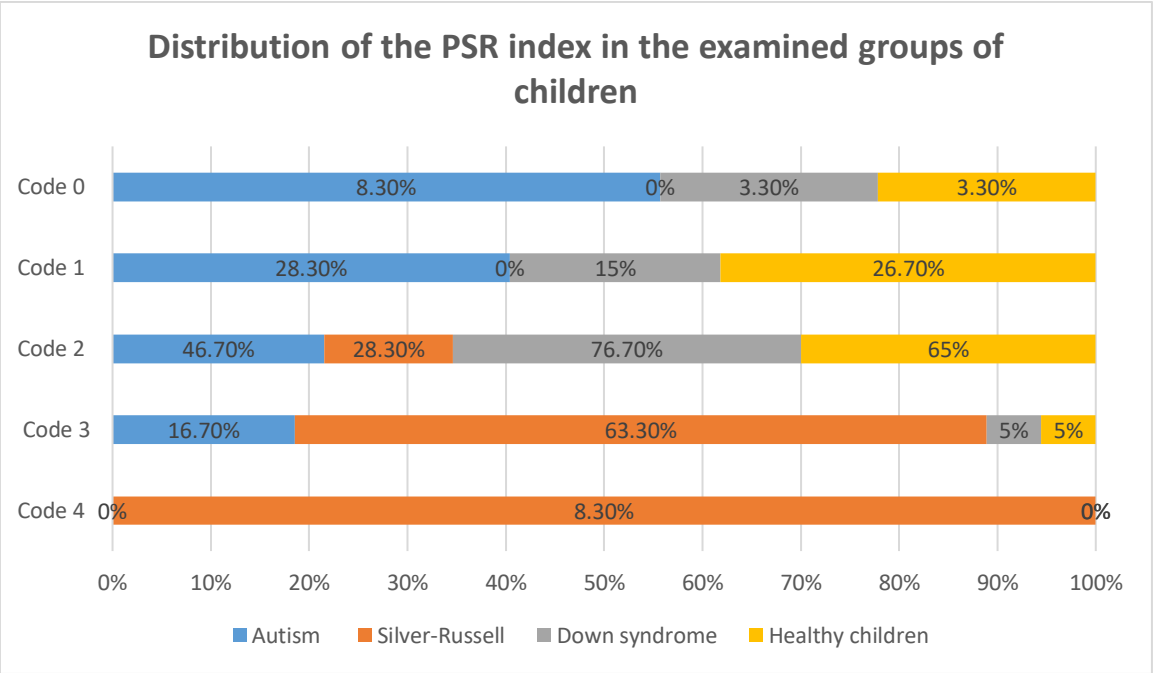
Table 10. Descriptive statistics by age groups in healthy children

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
GI Loe-Silness	< 6 years	15	0,3473	0,31013	0,08007	0,1756	0,5191	0,00	1,33
	6-12 y.	30	0,9543	0,49241	0,08990	0,7705	1,1382	0,17	2,00
	> 12 years	15	1,3220	0,53533	0,13822	1,0255	1,6185	0,70	2,30
	Total	60	0,8945	0,57827	0,07465	0,7451	1,0439	0,00	2,30

In healthy children, the differences between the average values of the gingival index by age groups **were statistically significant - F = 16.883, p<0.001.**

When calculating the values of the PSR index in the four studied groups, in the groups of children with autism, Silver-Russell syndrome and healthy children, values are observed mostly in code 0,1 and 2, which is characterized by the absence or presence of gingival bleeding and dental plaque. In children with Down syndrome, the highest prevalence was observed in code 2,3 and less in code 4. Features include the presence of plaque, bleeding and loss of attachment, with a probing depth of more than 4mm, indicating periodontal disease.

In children with autism, most of the examined children were with code 2 – 46.7%, followed by 28.3% with code 1, 16.7% with code 3 and 8.3% with code 0. In children with Silver-Russell syndrome, 76.7% of the examined children report code 2 according to the PSR index, 15% - code 1, 5% - code 3 and 3.3% - code 0. In children with Down syndrome, the most many children in code 3 - 63.3%, in code 2 - 28.3% and 8.3% in code 4. In healthy children, the highest percentage is in code 2 - 65%, followed by code 1 - 26 .7%, code 3 – 5% and code 0 – 3.3%. The results are presented in Graph 12.



Graph 12. Distribution of the PSR index in the examined groups of children

When measuring the probing depth in the studied groups, the calculated average value in children with Down syndrome was 4.14±0.82. In children with autism, a value of 3.47±0.80 was measured, in children with Silver-Russell syndrome – 2.89±0.63, and in healthy children – 2.96±0.59. The obtained results show a **statistically significant difference** between the studied groups - **F = 29.812, p<0.001**. (Table 10)

Table 10. Descriptive statistics for probing depth (mm) by group of children

Probing depth (mm.)								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Autism	60	3,472	,8032	,1037	3,264	3,679	2,0	6,0
Silver-Russell	60	2,898	,6310	,0815	2,735	3,061	1,5	4,1
Down syndrome	60	4,142	,8220	,1061	3,929	4,354	3,0	6,0
Healthy children	60	3,517	,5998	,0774	3,362	3,672	2,0	5,0
Total	240	3,507	,8412	,0543	3,400	3,614	1,5	6,0

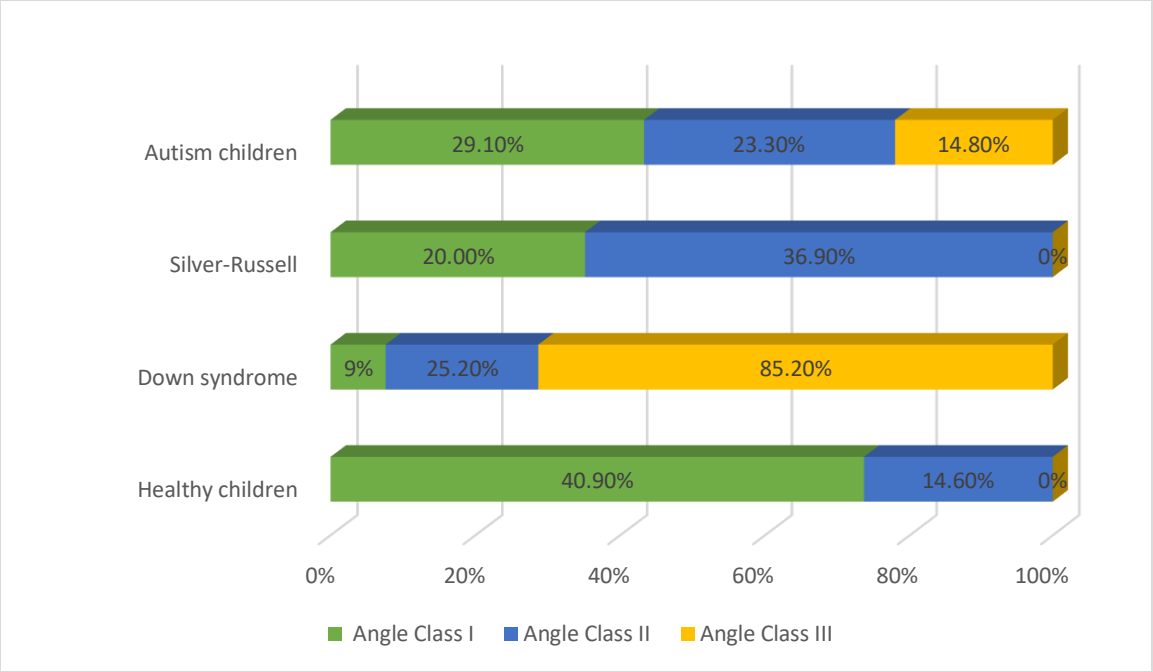
Discussion for objective 2

Periodontal diseases are inflammatory diseases of the supporting structures of the teeth. They are initiated by periodontopathic bacteria and lead to progressive destruction and loss of the periodontium. The progression of periodontal disease eventually leads to tooth loss. (107) In children with Down syndrome, gingivitis and periodontitis begin early in childhood and the clinical picture worsens with age. (312) The results of our study showed the most severe periodontal status in children with Down syndrome, with a gingival index of 1.51±0.64 and a mean probing depth of 4.14±0.82. Periodontal problems in children with Down syndrome have been the subject of many studies. (8, 84, 106, 155, 171) The rapid progression of periodontal disease in these patients is largely due to T-cell immune deficiency and reduced mature T-cell, monocyte, and polymorphonuclear leukocyte defects combined with poor oral hygiene. . (80, 85) An almost similar gingival index was observed in the remaining groups of examined children, including in the group of healthy children. When measuring probing depth and PSR index, periodontal involvement was not as severe as in children with Down syndrome. In children with Down syndrome, the presence of dental plaque is not the causal reason for the development of periodontal disease, but it significantly complicates the clinical picture and aggravates the course of the disease. Poor oral hygiene, the presence of gingival inflammation and plaque increase the risk of a more severe course of aggressive periodontitis, which is observed quite often in these patients. Children with Down syndrome have a higher titer of antibodies against Actinobacillus actinomycetemcomitans. (101, 206), which is a characteristic periodontopathogen in aggressive periodontitis.

Results for objective 3

The orthodontic status of the examined patients was also recorded in the outpatient records, and the indicators that were examined included deviations in the occlusion and in the individual arch. From the point of view of the occlusal relationships that are observed, normal occlusion or Class I according to Angle have 110 of the examined children - 32 (29.1%) of them are children with autism, 22 (20%) have Silver-Russell syndrome , 10 (9.09%) had Down syndrome and 45 (40.9%) were healthy controls. Angle class II (distal occlusion) was observed in 103 children studied. The largest share of them is occupied by children with Silver-Russell syndrome - 38

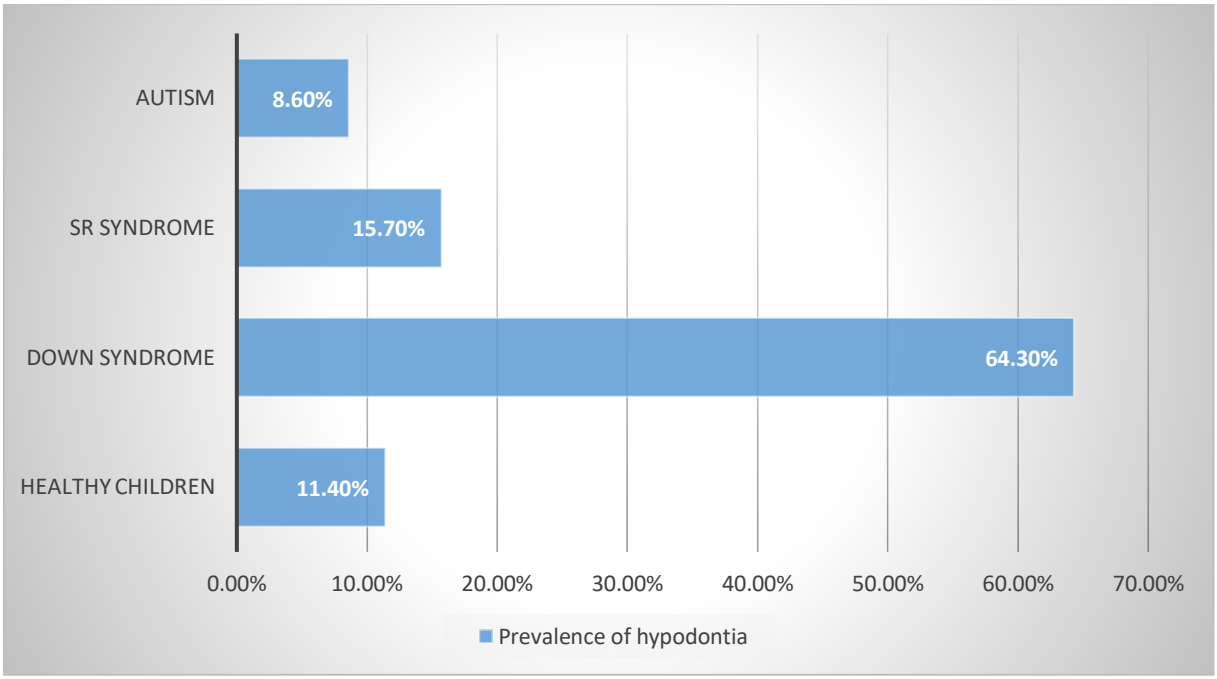
(36.9%), in second place are children with Down's syndrome - 26 (25.2%), followed by children with autism - 24 (23.3%) and healthy children – 15 (14.6%). This shows **a statistically significant difference** between the presence of distal occlusion in children with Silver-Russell syndrome compared to other studied groups - **χ^2= 68.100, p<0.001.** Angle class III (medial occlusion) was observed in 27 children, 24 of whom had Down syndrome (85.2%) and 4 had autism (14.8%). This shows **a statistically significant difference** between the presence of medial occlusion in children with Down's syndrome compared to other studied groups - **χ^2= 68.100, p<0.001**. The strength of the relationship is determined by Cramer's coefficient V = 0.377. This coefficient is statistically significant (moderate correlation). (Graph 13)



Graph 13. Distribution of the studied groups by type of occlusion according to Angle's classification.

Of the studied groups, the highest prevalence of hypodontia was observed in the group with Down syndrome. The means of determining whether hypodontia is present include clinical and radiographic examination. Clinical examination includes assessment of malocclusion according to Angle's classification of malocclusion based on anterior-posterior relationships. X-ray examination is done if the clinical examination is not sufficient to determine if hypodontia is present. The criteria for hypodontia are met if the tooth is not in the dental arch, if it cannot be seen on a radiograph, and if there is no previous history of its extraction or expulsion. From all groups of children studied,

70 (29.17%) children have hypodontia, 45 of them have Down syndrome (64.3%), 11 have Silver-Russell syndrome (15.7%), 6 have with autism (8.6%) and 8 were healthy controls (11.4%). The prevalence of hypodontia in children with Down syndrome had a **statistically significant value with χ^2= 22.405, p< 0.001.** Coefficient Cramer's V = 0.566, which indicates a significant correlation. (Graph 14)



Graph 14. Percent prevalence of hypodontia among the studied groups of children.

In the Down syndrome hypodontia group, 20 (44.44%) were boys and 25 (55.56%) were girls. The most common missing teeth are the upper lateral incisor, the upper second premolar, the two lower incisors and the lower second premolar. Boys showed a higher prevalence of hypodontia on the left side of the maxilla, with 12 missing lateral incisors (42.86%) and 7 missing second premolars (25), while girls showed a high prevalence on the right side with 11 missing lateral incisors (34, 37%) and 10 missing second premolars (31.25%). In the mandible, the prevalence was higher on the right side for both sexes with 8 missing lateral incisors (28.57%) and 5 missing second premolars in boys and 8 missing lateral incisors (25%) and 10 missing second premolars (31, 25 %) for girls.

A significant difference was found between girls and boys regarding maxillary and mandibular lateral incisors at $p<0.05$. There is no significant difference between girls and boys regarding maxillary and mandibular second premolars at $p>0.05$.

Among the children with autism, 28 children (46.7%) had a slight orthodontic deformity, calculated according to Petrunov's classification. Among the most common deformities, a deviation in the position of the teeth of no more than 3 teeth is observed - in 11 (18.33%) children, a distal bite from 1/3 to ½ a measurement unit in a mixed dentition - 16 (26.67%) children and crossbite in 15 children (25%).

Moderately severe orthodontic deformity was observed in 15 children (25%)

a) overjet of 3-6 mm in 5 (8.33%) children

b) distal bite ½ to 1 measurement unit in 3 (5%) children

c) medial bite from 1/3 to ½ in 4 (6.7%) children.

Severe deformity with hypodontia of single teeth was observed in 6 children (10%) (Graph 15)

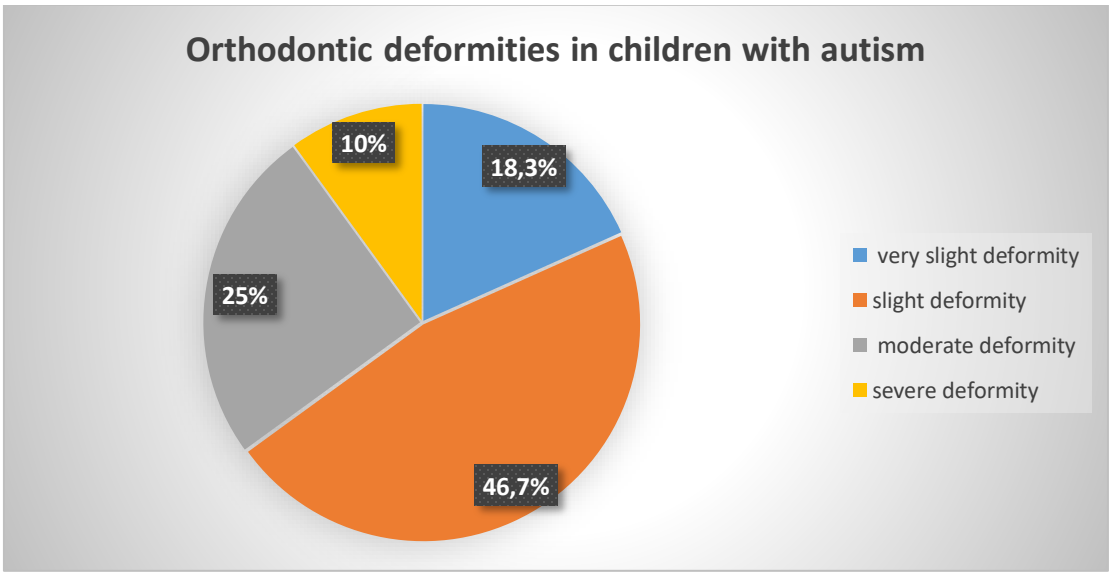


Chart 15. Orthodontic deformities in children with autism

Among the children with Silver-Russell syndrome, 32 (53.3%) children have a mild deformity

a) deviation in the position of the teeth is present in 23 children (38.3%)

b) distal bite from 1/3 to ½ was observed in 13 children (21.67%)

c) 18 children (30%) have a crossbite in the lateral region

Moderately severe deformity was observed in 10 children (16.67%)

a) distal bite of ½ to 1 measurement unit was observed in 8 children (13.3%)

b) 6 children (10%) have a unilateral crossbite in the lateral region of more than 2 pairs of antagonists

Severe deformity was observed in 11 children (18.3%) with hypodontia of single teeth, 3 children (5%) had distal occlusion above 1 unit of measurement in mixed dentition, and 7 children had deep occlusion with crown coverage of the lower incisor (11.67%). (Graph 16)

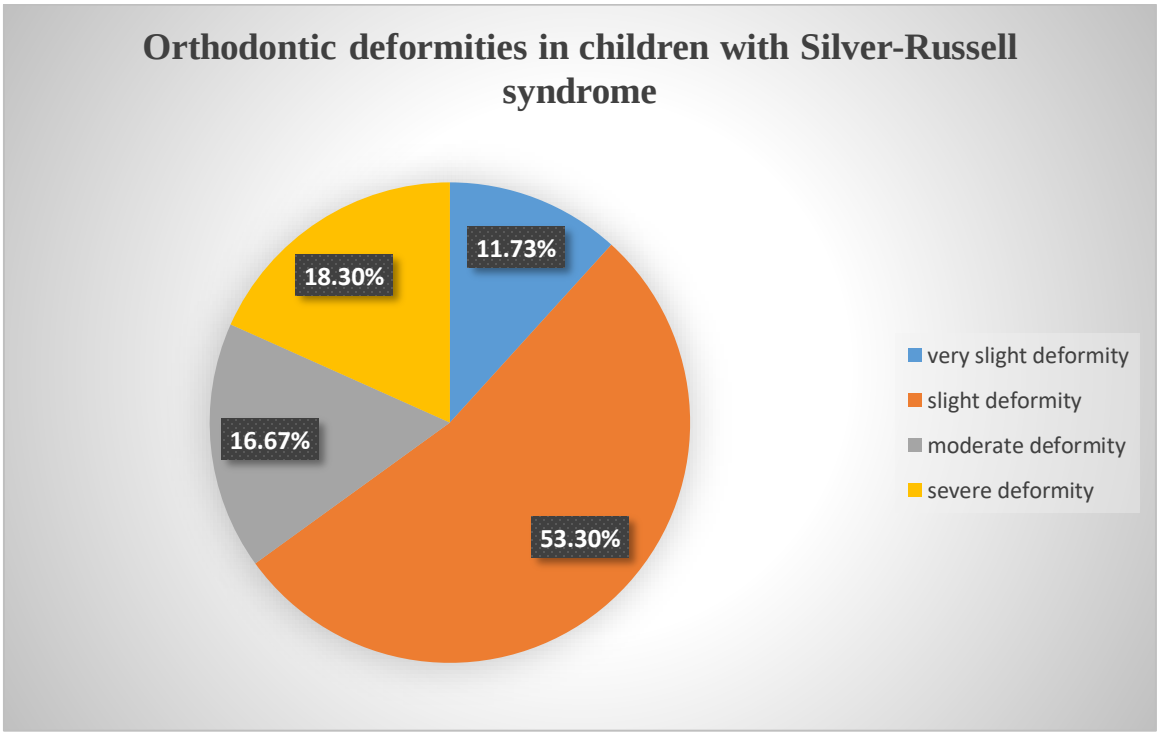
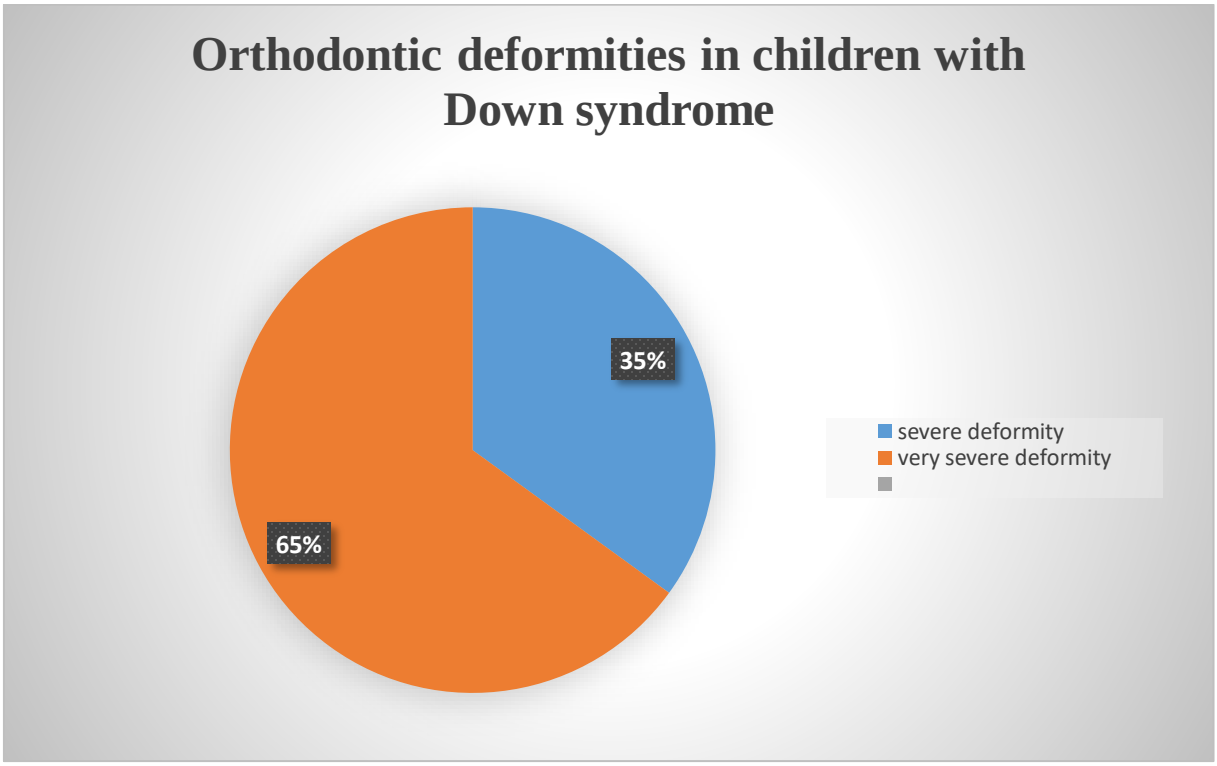


Chart 16. Orthodontic deformities in children with Silver-Russell syndrome

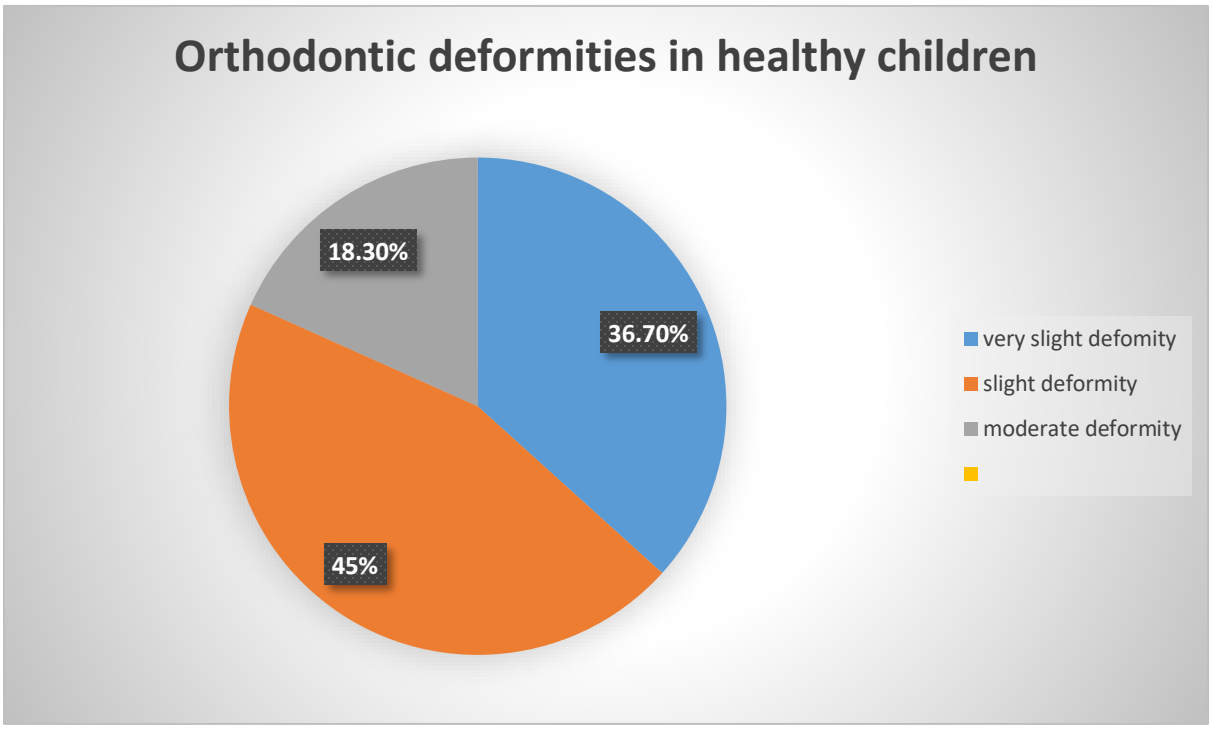
In children with Down syndrome, severe and very severe deformities according to the classification are observed to a greater extent, due to multiple hypodontia in many of them. Severe deformity was observed in 21 children (35%) and in 6 (10%) of them hypodontia of single teeth was observed, in 8 (13.33%) children an open occlusion of 1-3 mm was observed, in 9 children it was observed

cross-occlusion of 2 or more pairs of antagonists (15%). Very severe deformity was observed in 39 (65%) children who had multiple hypodontia, 10 (16.67%) children had an open bite greater than 3 mm and 17 (28.3%) had a medial bite greater than 1 unit of measurement. (Graph 17)



Graph 17. Orthodontic deformities in children with Down syndrome

In the healthy children, 27 (45%) had a mild deformity, with 9 (15%) of them having a distal bite of 1/3 to ½ measurement unit and 9 (15%) having deviations in the position of the teeth. 11 children (18.3%) have moderately severe deformity. The rest have very slight deformity or no deformity. (Graph 18)



Graph 18. Orthodontic deformities in healthy children

Discussion for objective 3

The aim of the present study was to evaluate malocclusions and the presence of dental anomalies in the studied groups of children. According to the obtained results, the high prevalence of Class III malocclusion in children with Down syndrome was confirmed. The presence of macroglossia combined with a tongue protruding from the mouth, highly furrowed with fissures, leads to more frequent dento-maxillofacial deformities, characterized by Angle Class III and an open bite in the frons. (8, 48, 59, 163, 171) Fink et al. observed a significant degree of deficit in the midface region, skull base, frontal bone, and paranasal sinuses in cases of children with Down syndrome. (151) These features of the skull lead to vertical hypoplasia of the central structures of the skull, with a lowering of the position of the sella turcica and subsequent flattening of the skull base, which accounts for the high incidence of Angle Class III malocclusion. (46) The following rates of class III malocclusion have been reported in other studies: Cohen and Weiner—37.7%, Gullikson—50%, Brown and Cunningham—49%, Swallow—61% in institutions and 26% at home, Gorlin&Robert—60 % and Patel&Boghani—44.3%. The results of our study revealed a high prevalence of Angle class II in children with Silver-Russell syndrome. Jaw compression with crowding of teeth and cross-occlusion is also seen. This is confirmed by the research of other

authors. (78, 182) When tracking the frequency of hypodontia in the studied groups, the group of children with Down syndrome showed the highest prevalence with 64.3%. The most frequently missing teeth are the lateral incisors, followed by the second premolars, with a higher number in girls. Boys show a lower rate than girls, which may be due to smaller jaw sizes in girls or may be due to an X-linked genetic disorder. Trisomic cells have slower intermitotic periods, resulting in a decrease in the number of cells in many organs of the body. As a result, there is general growth retardation in children with Down syndrome, as well as frequent hypodontia. (96, 297) Hypodontia is also seen in children with Silver-Russell syndrome. This is also confirmed by other authors. (182, 200, 211)

Results for objective 4

In addition to the clinical research results, parents of children with autism and some syndromes and dentists were asked to complete a questionnaire regarding their awareness of children's oral health. The survey conducted is anonymous and includes 10 questions for parents and 10 questions for dentists. The purpose of the surveys is to assess the awareness of parents and doctors about the oral health of children with autism and syndromes, so that, if necessary, current and useful information can be provided to improve oral health care at home and in the dental office.

180 parents of children with autism and syndromes took part in filling out the survey. The results of the parent survey are presented in Table 11.

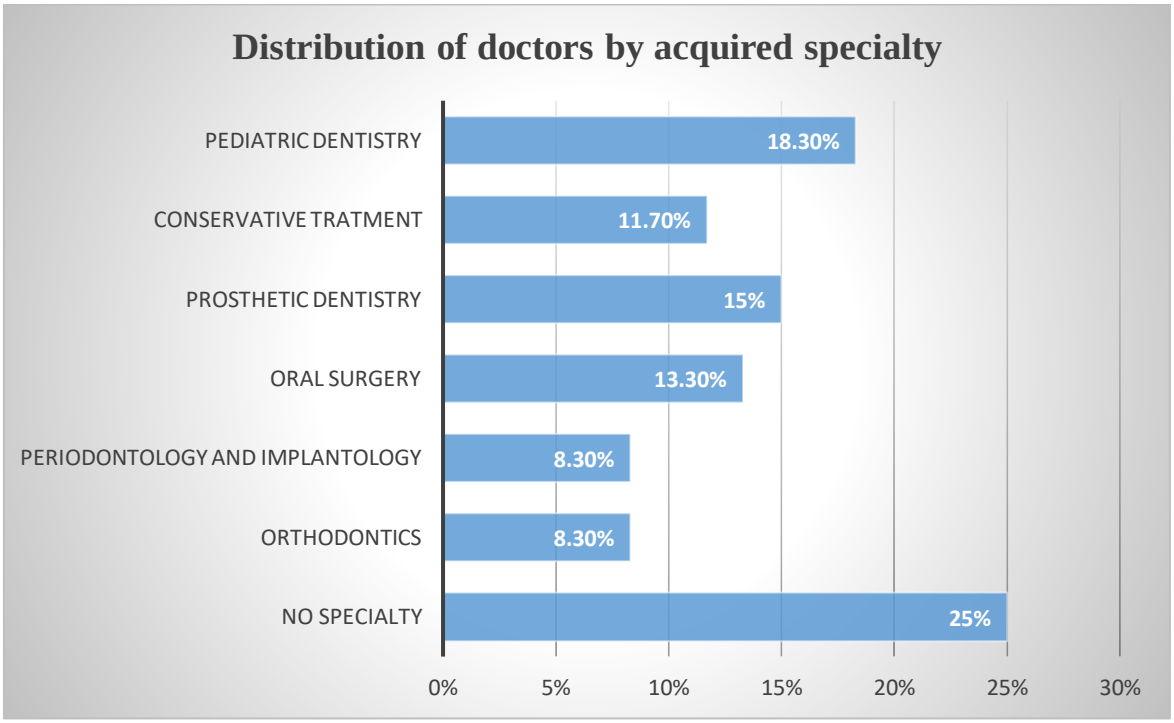
Table 11. Results of a survey conducted on the awareness of parents of children with autism and some syndromes.

Questions	(N%)	(N%)	(N%)	(N%)
1. How do you rate your awareness of your child's oral health and preventive guidance received?	Very good 21 (11,7%)	Good 18 (10%)	Intermediate 58 (32,2%)	Insufficient 83 (45,8%)
2. What difficulties do you most often experience when seeking dental care for your child?	Negative behavior of the child 7 (3,9%)	Financial difficulties 5 (2,8%)	Fear 59 (32,8%)	Difficulty in finding a dentist 109 (60,6%)

3. Where do you get information about your child's oral health?	Informative materials 22 (12,2%)	Internet 76 (42,4%)	My dentist 44 (24,2%)	Nowhere 38 (21,2%)
4. In your opinion, is it necessary to change or update the existing recommendations and advice related to your child's oral health?	Yes 85 (47,2%)	Partly 74 (41,1%)	No 21 (11,7%)	No opinion 0 (0%)
5. Do you know how often your child's teeth should be brushed?	Yes 142 (78,9%)		No 38 (21,1%)	
6. Did you know that eating carbohydrates as snacks can increase your child's risk of tooth decay?	Yes 100 (55,6%)		No 80 (44,4%)	
7. Are you aware that the use of certain medications can lead to dry mouth and gum growth in your children?	Yes 85 (47,2%)		No 95 (52,8%)	
8. What are the reasons for seeking dental care?	Emergency case 79 (43,9%)	Regular check-up 26 (14,4%)	Treatment of caries 75 (41,6%)	
Is it a priority to perform oral hygiene and regular examinations at the dentist, against the background of the general condition of the child?	Yes 113 (62,8%)	Mostly yes 67 (37,2%)	Mostly no 0 (0%)	No 0 (0%)
10. Do you find the provided materials for carrying out preventive and curative activities useful and did you learn something new from them?	Yes 140 (77,8%)	Mostly yes 23 (12,8%)	Mostly no 17 (9,4%)	No 0 (0%)

60 doctors who have treated at least one child with autism or syndrome took part in filling out the survey for dental doctors. Of them, 22 are men (36.7%) and 38 are women (63.3%). Twenty-seven of the surveyed doctors have professional experience of 10 years (45%), 23 have experience of 10-20 years (38.3%) and 10 have experience of 20-30 years (16.7%). The distribution of doctors according to the acquired specialty is as follows: The largest percentage of the surveyed doctors do

not have a specialty - 25%, in second place are doctors with a specialty of Pediatric dentistry (18.3%), since the survey is mainly aimed at them. followed by Prosthetic Dentistry (15%), Oral Surgery (13.3%), Operative Dentistry and Endodontics (11.7%) and Orthodontics and Periodontology and Implantology - 8.3%. The results are presented in the following figure. (Graph 19)



Graph 19. Distribution of doctors by acquired specialty

The results of the surveys are presented in Table 12.

Table 12. Results of a survey of dentists regarding their awareness of the treatment of children with autism and syndromes

Questions	(N%)	(N%)	(N%)	(N%)
4. „Have you performed dental treatment on a child with autism or syndromes?'	Yes, one or more than one 100 (100%)	No 0 (0%)	I don‘t know 0 (0%)	I don‘t treat children 0 (0%)

5. How confident do you feel treating children with autism and syndromes in an outpatient setting?	Not confident 30 (50%)	Very confident 18 (30%)	I don‘t know 12 (20%)
6. Outside of your studies, have you received additional lecture/practical training related to the dental treatment of children with autism or syndromes?	Yes 31 (52%)		No 29 (48%)
7. Are you familiar with the oral manifestations caused by commonly taken medications?	Yes 29 (48%)		No 31 (52%)
8. How do you approach treating a child with autism or syndrome?	I do treatment like with any other child 17 (28,3%)		I send the child to a pediatric specialist 43 (71,7%)
9. Are you familiar with the most common oral manifestations that occur in these children?	I am familiar 14 (23,3%)		I am familiar, but I would like to learn more 46 (76,7%)
10.When treating children with autism or syndromes, did you come into contact with other treating doctors?	Yes 35 (58,3%)	No 18 (30%)	In a team under GA 7 (11,7%)

The results of our study show that dental practitioners are not prepared to work with children with autism and syndromes. Due to a lack of adequate professional information, these children do not receive the necessary oral health care. These results are confirmed by other studies. (43, 135, 357)

Despite the available comprehensive studies and protocols conducted over the years, unsatisfactory results have been observed following the conduct of parent and physician awareness surveys. Based on the results obtained in tasks 1,2,3,4 and the existing recommendations and protocols compiled over the years in our and world literature, updated protocols for prevention, treatment and facilitation of dental office visits for children with autism and some syndromes.

Protocol for parents

Make an appointment for a dentist

It is recommended that all children make their first visit to the dentist 6 months after the first tooth erupts in the mouth or by 1 year (whichever comes first).

Parents of children with autism and syndromes can contact a primary care doctor or nurse for help in finding a suitable dentist for their child. It helps the dentist when the parent of the patient starts the conversation beforehand in the following way:

Hello I am _____

I am calling to make an appointment for my child _____

My child has special needs. My child has _____

Are you the person I need to talk to about my child's needs, or is there someone else available in your office that I can talk to?

My child does best when_____

My child is afraid of _____

My child will feel more comfortable in your office if _____

In the past, my child had a successful dental visit when _____

In the past, my child had difficulties at the dentist when _____ (129)

2. It is recommended that the first visit to a dental office be carried out before the first year of the child's life, in order to determine the risk factors for the development of oral diseases. After taking a detailed history and clinical examination, parents should receive comprehensive information about their child's current oral condition and possible risks in the future. Parents should have a key role in the process of protecting children's oral health and in the prevention of possible complications of oral diseases.

Before a dental examination

• Talk to your child about going to the dentist. Use words your child understands and a positive or neutral tone of voice. Avoid using words like "pain" and "breakthrough." Sometimes pictures or books help explain what will happen. If children feel more relaxed with a certain toy or object, it can help make for a more positive experience in the dental office.

• Make suggestions to the dental office to help make the visit a success. Be clear and specific about what will help your child at the screening. Share past dental experiences, both positive and negative, with the office staff.

• If possible, make a dental appointment for the time of day that is best for your child.

• Notify the dentist's office that your child's treatment may take longer.

• If your child has any medical problems, tell the dentist before the visit.

Day of dental examination

• Bring a list of all medications your child is taking.

• Share with the dental team the most successful way to talk or communicate with your child.

• Tell the dentist what your child might do and the best way to deal with how he or she might behave. Offer things that make your child feel good.

• Ask for help with different teeth cleaning ideas that will make it easier to care for your child's teeth at home.

• Bring a list of any questions you may have about your child's teeth.

• Tell the dentist that you would like to talk about any treatment before it is done.

• Ask who to call or where to go if your child has a dental problem and the dental office is closed.

Keeping teeth and gums healthy

• Encourage your child to rinse with water after taking medications that can cause "dry mouth." Dry mouth can lead to faster tooth decay.

• Know what is normal in your child's mouth. Lift the lips away from the teeth to get a better view of your child's teeth and gums. Watch often.

• Follow a daily dental care plan for your child: brush twice a day with fluoride toothpaste. Oral hygiene procedures should be carried out twice a day, with a suitable paste and brush, a pea-sized amount of toothpaste, with an optimal duration of 3 minutes, and should be carried out either under the supervision of the parent/guardian or by himself him.

• In families of children with autism and syndromes, the focus quite often shifts from oral health as care is required related to the general condition of the child. This can lead to insufficient motivation to devote sufficient time and effort to oral hygiene.

• For children with autism, instead of a regular toothbrush, find a toothbrush with soft or silicone bristles. These gentler toothbrushes can help reduce the sensitivity of a child's mouth and gums. In children with hyposensitivity, it is recommended to use an electric toothbrush, as it makes sufficient movements to clean the teeth and helps to provide additional stimulation in these patients.

• Washing should be ensured with a suitable paste, and for some children with autism, in order to avoid overloading the senses, it is recommended that the paste does not contain sodium lauryl sulfate, which leads to the formation of foam. It is recommended to monitor the child's reaction to the paste, and it may take several attempts to find the right paste. For some children, the presence of the paste or mint flavor may cause additional irritation, so it is desirable to use pastes without flavor or strong smell. The amount of fluoride in the paste should be adjusted to the age of the child, since most patients do not have a developed habit of spitting and swallow a large part of the paste.

• Oral hygiene must be performed under the supervision of a parent or the parent himself. For children with autism, it is desirable to establish a routine that includes informing the child in advance that it will be time to brush his teeth at a certain time. The child should be given a few minutes to transition from what he is doing to entertaining the idea of brushing his teeth. Using a song or visual timer is recommended so the child knows how long the task will take. Very good

results have been achieved with the use of the picture system for non-verbal communication PECS (Picture exchange communication system) and Makathon.

• Have your child drink fluoridated water. Use all the aids recommended by the dentist to keep your child's teeth and mouth clean.

• Due to the high risk of developing oral diseases, the use of additional means for LOH, such as gargling solutions, is also recommended. The content of chlorhexidine should be 0.1% after reaching the age at which the child can spit. These waters help to prevent the overgrowth of Candida albicans due to the intake of medication. In addition to gurgling solutions, the use of weekly 0.2 mg/ml F is also recommended, again after the spitting age is reached.

• After taking the main and intermediate meals, it is advisable to rinse the oral cavity with water.

• For additional prevention at home, the Tooth Mousse GC remineralizing paste can be used. Its application is most effective in the evening, after brushing the teeth with a brush and paste, and it is applied to the tooth surfaces before going to bed. A preventive effect is achieved after use every night for at least 3 months, after which a pause of up to 2 months can be made and the use can be continued again.

• Due to the frequent observation of reduced salivary secretion in patients taking various medications, the use of sugar-free chewing gum is desirable, as they stimulate salivary flow and a protective effect occurs, thanks to the buffer capacity. This can also be achieved through the use of foods that also stimulate saliva flow and do not stick to tooth surfaces.

• Avoid offering your child sugary snacks and drinks (juices, purees) and avoid using them as rewards. Look on food labels for words ending in "-ose," such as "fructose" and "sucrose," and limit your use of them.

• Do not share utensils, cups and toothbrushes with your child to avoid passing on the bacteria that can cause tooth decay. If your child uses a pacifier, do not dip the pacifier in honey or sugar and clean it with water only.

• Do not serve juice in sippy cups, only in open glasses. If you must put a child to bed with a bottle, fill it only with water.

• If your child knocks out a tooth, try to put the tooth back into the socket immediately and seek professional dental care. If you cannot get the tooth back, put it in cold fresh milk and go to the dentist immediately.

• Use seat belts, stair gates, bicycle helmets and mouth guards to prevent injury to teeth and face.

• Take your child to the dentist for checkups and cleanings as recommended based on your child's chance of developing cavities. The visit to the dental office should take place every 3 months, for timely prevention and treatment. Based on the established caries risk of the patient, the dentist can make changes in the individual preventive program of the specific patient, and these changes should be followed to optimize the oral health of the patient. Due to the high caries risk of these patients, it is recommended to carry out exogenous fluoride prophylaxis at least 4 times a year, as well as silanization of the newly erupted permanent teeth, and sometimes also of the temporary ones. In the presence of a large volume of work, severe pathology or non-cooperation on the part of the patient for work in ambulatory conditions, it is desirable to perform manipulations in the oral cavity under sedation or general anesthesia. Ask the dentist to draw up an individual preventive program to protect your child from caries and periodontal diseases.

These actions will help prevent cavities, fractures and periodontal problems in your child. (374)

Protocols for dentists

Tretment of children with autism

• When a child with autism is admitted to the office, the environment should be pleasant and conducive. The child is brought into the office together with the parent.

• Use of a "tell-show-do" and "do as I do" approach is recommended in communicating with these patients. Start by explaining each procedure before it happens. Take the time to show the tools you'll be using and how they work. Demonstrations may encourage some patients to be more cooperative. For children who are more hyperactive, it is good to schedule a desensitization class to help the patient familiarize themselves with the office, staff, and equipment step by step.

• Completing these steps may take several visits. Have the patient sit alone in the dental chair to familiarize himself with the office. Some patients may refuse to sit in the chair and instead choose

to sit in the operator's chair. Once your patient is seated, begin a cursory examination with your fingers. Then use a toothbrush to brush the teeth and gain additional access to the patient's mouth. Familiarity with the toothbrush will help your patient feel comfortable and allow you to further examine the mouth. Using a reward as an incentive is a good strategy for controlling behavior.

• When the patient is prepared for treatment, keep the appointment short and positive. Pay special attention to treatment attitude. Keep dental instruments and light away from the patient's eyes. Praise and support good behavior after each step of the procedure. Ignore the inappropriate behavior as much as you can. Try to gain cooperation in the least restrictive way.

• Some patients' behavior may improve if they wear objects that bring comfort, such as a stuffed animal or blanket. Asking the parent to sit nearby or hold the patient's hand can also be helpful.

• If all other strategies fail, pharmacological options are useful in the management of some patients. Others must be treated under general anesthesia. However, caution is necessary because some patients with developmental disabilities may have unpredictable reactions to medications.

• People with autism need consistency and can be particularly sensitive to changes in their environment. They may exhibit unusual sensitivity to sensory stimuli such as sound, bright colors and touch. Reactions vary: Some people with autism may overreact to noise and touch, while exposure to pain and heat may not elicit a reaction at all.

• Use the same team, operator and review time. These details can help make dental treatment seem less intimidating.

• Minimize the number of distractions. Try to reduce unnecessary sights, sounds, smells or other stimuli. Also consider reducing ambient light and ask the patient's parent if soft music will help.

• Allow time for your patient to adapt and become desensitized to dental office noise. Some patients may be hypersensitive to the sound of dental instruments. Talk to the parent to find out the patient's tolerance level.

• Children with autism differ in the way they accept physical contact. Some are defensive and refuse any contact in or around the mouth, or touching the head or face. Others find such a touch comforting. Record your findings and experience in the patient's chart.

• Seizures can accompany autism, but can be controlled with anticonvulsant drugs. The mouth is always at risk during a seizure: patients may break teeth or bite their tongue or cheeks. Children with controlled seizures can easily be treated in an outpatient setting. Consult the patient's physician. Record the information on the chart about the frequency of seizures and the medications used to control them. Determine before the examination if any medications are taken. Know and avoid any factors that trigger your patient's seizures.

• The risk of dental caries is increased in patients who have preferences for soft, sticky or sweet foods, bad oral habits and difficulty brushing and flossing. Recommend preventive measures such as exogenous fluoride prophylaxis and sealants.

• Care must be taken when taking medications that reduce saliva or contain sugar. Advise patients to drink water frequently, take sugar-free medications when possible, and rinse with water after taking any medication. Advise parents to offer alternatives to cariogenic foods and drinks as incentives or rewards.

• Ask patients to show you how they brush their teeth and perform hands-on demonstrations to show them the best way to clean their teeth. If appropriate, show patients and parents how using a modified toothbrush holder or dental floss can facilitate oral hygiene. Some patients cannot brush or floss without parental supervision. Talk to parents about daily oral hygiene. Demonstrate brushing techniques to each patient, which can also be done through the use of pictures and videos. Makathon and PECS are popular methods used with autistic children that use pictures and symbolic sentences for an enhanced visual learning experience.

• The dentist may also learn phrases such as 'open your mouth' or 'sit in the chair'. They can help the patient become familiar with the office. Emphasize that a consistent approach to oral hygiene is important—parents should try to use the same location, time, and positioning.

• Periodontitis occurs in people with autism in much the same way as in people without developmental disabilities. Some patients benefit from daily use of an antimicrobial agent such as chlorhexidine. (270)

• If orthodontic treatment is needed that involves taking an impression, let the child know which spoon will be placed first (top or bottom) and how many seconds it should remain in the mouth.

You can also ask the child to communicate using hand signals when they feel discomfort or need a break during the procedure.

• Conventional braces are attached to the teeth and may take some time for children to adjust to. Parents or carers should be aware that there may be sores and children may feel the braces as 'foreign'. Accurate cleaning instructions should be given after braces are placed to prevent any gum or tooth related problems.

• One technique to facilitate the performance of orthodontic treatment is the use of a Picture Activity Schedule, where pictures are used to show the steps of the procedures rather than describing them verbally. These photos of the orthodontic procedure steps are shown to the patient daily during the week or two prior to placement. Photos can be viewed by the child's parent. A wide variety of orthodontic procedures have been successfully performed using this technique. Fitting just a few braces and allowing the patient to get used to the feel of them may produce a better behavioral response than fitting a full range of braces. Also, placing a few braces only without wire and colored ligatures is another way to ease the child's perception of orthodontic treatment. (332)

Treatment of children with Down syndrome and Silver-Russell syndrome

• Before the examination, take and review the patient's medical history. Consultation with physicians, family, and caregivers is essential in obtaining an accurate medical history. Also, determine who can legally give informed consent to treatment.

• Listen actively as speaking can be difficult for people with Down syndrome. Show your patient that you understand. Talk to the parent or caregiver to determine your patient's intellectual and functional abilities, then explain each procedure at a level the patient can understand.

• Take extra time to explain oral health issues or instructions and demonstrate the tools you will use. Use simple, specific instructions and repeat them often to compensate for any short-term memory problems.

• Talk to the caregiver or doctor about techniques they have found to be effective in managing the patient's behavior. Share your ideas with them and find out what motivates the patient.

• Schedule patients early in the day if possible. Early appointments can help ensure that everyone is alert and attentive and that wait times are reduced. Set the stage for a successful visit by involving the entire dental team.

• Provide oral care in an environment with few distractions. Try to reduce unnecessary sights, sounds, or other stimuli that may make it difficult for your patient to cooperate.

• Plan the examination step by step, starting with placing the patient in the dental chair. If this is successful, perform a review using only your fingers. If that goes well too, start using dental tools.

• Prophylaxis is the next step, followed by dental radiography. It may take several visits to complete these tasks. Try to be consistent in all aspects of oral health care. Use the same team, operator, meeting times and other details to maintain familiarity. The more consistency you provide your patients, the more likely they are to cooperate. Comfort children who resist oral care and reward cooperative behavior with compliments during the appointment.

• Hypotonia affects muscles in various areas of the body, including the mouth and large skeletal muscles. When it affects the mouth, it leads to an imbalance of forces on the teeth and contributes to open bite. If the muscles that control facial expression and mastication are affected, problems with chewing, swallowing, salivation and speaking may occur.

• Traumatic oral injuries are quite common among children with Down syndrome due to the frequency of falls or accidents. It must be emphasized that traumatic injuries require immediate professional attention with an explanation of the procedures to be followed if a permanent tooth is knocked out - to return it to the alveolus or, failing that, to put it in fresh milk until reaching a dental office.

• Seizures sometimes occur in patients with Down syndrome, especially in infants, but can usually be controlled with anticonvulsant drugs. The mouth is always at risk during a seizure: patients can break teeth or bite their tongue or cheeks. People with controlled seizures can easily be treated in the general dental office. Consult the patient's physician. Record information in the table about the frequency of seizures and the drugs used to control them. Determine before the examination that the medications have been taken as directed. Know and avoid any factors that trigger your patient's seizures. Be prepared to manage a fit. If it occurs during oral care, remove all instruments from the mouth and clean the area around the dental chair. Do not try to insert objects between the teeth

during a seizure. Stay with the patient, turn him on his side and monitor the airway to reduce the risk of aspiration.

• Periodontitis is the most significant oral health problem in people with Down syndrome. Periodontal disease develops aggressively and progresses rapidly. Consequently, a large number of them lose their permanent front teeth in their early teens. Contributing factors include poor oral hygiene, malocclusion, bruxism, tapered tooth roots, and abnormal host response due to a compromised immune system.

• Some patients benefit from daily use of an antimicrobial agent such as chlorhexidine. Recommend an appropriate delivery method based on your patient's abilities. Gargling, for example, may not work for someone who has difficulty swallowing or someone who cannot expectorate. Chlorhexidine applied by spray or toothbrush is equally effective. If the use of certain medications has led to gingival hyperplasia, emphasize the importance of daily oral hygiene and frequent professional cleanings. Ask patients to show you how they brush their teeth and follow up with specific recommendations about brushing methods or toothbrush adaptations.

• Engage patients in hands-on brushing and flossing demonstrations. Some children with Down syndrome can brush and floss on their own, but many need help. Not all parents know the proper brushing and flossing techniques. An electric toothbrush or floss holder can simplify oral care. Emphasize that a consistent approach to oral hygiene is important – parents should try to use the same place, time and position.

• Advise patients taking medications that cause xerostomia to drink water frequently. It is recommended to take sugar-free medications, if available, and to rinse with water after dosing. Preventive measures such as topical fluoride prophylaxis and sealants are recommended.

• Emphasize non-cariogenic foods and beverages as snacks. Advise parents to avoid using sweet foods as incentives or rewards.

• Orthodontics should be carefully considered in children with Down syndrome. Some may benefit while others may not. Syndromes alone are not a barrier to orthodontic care. The ability of the patient or caregiver to maintain good daily oral hygiene is critical to the feasibility and success of treatment. The use of a panoramic radiograph is recommended to determine whether all teeth have germs. Patients often find this technique less threatening than segmental imaging. If hypodontia is

detected, milk teeth should be retained as long as possible. Placeholders should be considered where appropriate.(261)

• The open bite condition in children can be treated with the CastilloMorales orofacial therapy, which consists of two parts: a program of manual stimulation and facilitation and palatal stimulation through a removable orthodontic plate modified by Castillo-Morales.

• Patients with Down syndrome usually have ridges on the tongue, where food particles accumulate, leading to halitosis. This can be avoided by regularly brushing the dorsal surface of the tongue. Delayed teething is a common phenomenon among children with Down syndrome, which can occur up to 2-3 years in an unusual pattern. Selective extractions under the supervision of an orthodontist may benefit those Down syndrome patients with severe crowding of permanent teeth.

• The distance caused by microdontia can be corrected either by restorations or by orthodontic intervention.

• Before the examination, take and review the patient's medical history. Consultation with a physician, endocrinologist, gastroenterologist, family, and caregivers is essential in obtaining an accurate medical history.

Prevention and treatment of children with Silver-Russell syndrome

• Children with Silver-Russell syndrome often suffer from hypoglycemia. This requires frequent intake of foods rich in carbohydrates. Frequent intake of water, regular oral hygiene with fluoride toothpaste twice a day, as well as fluoride prophylaxis in the office and placement of sealants are advised.

• If palatal clefts are present, measures should be taken around 12-18 months of age to help with speech development.

• Crowding of teeth can be corrected by serial extraction, maxillary expansion, or symphyseal distraction to gain space for the compressed mandibular arch. Serial extraction is the planned and sequential extraction of temporary and permanent teeth to ensure a more favorable position of the rest.

• Growth hormone treatment is known to stimulate craniofacial growth, which may affect the outcome of orthodontic treatment. Specialists and orthodontists treating children with short stature should be aware of research findings on craniofacial morphology and educate themselves on the

topic of craniofacial growth in children with short stature. Furthermore, knowledge of the impact of growth hormone therapy on the growth of craniofacial structures is necessary to decide on the correct timing and planning of orthodontic treatment.

• Growth hormone treatment also affects vitamin D3 levels in children with Silver-Russell syndrome, leading to a decrease in the DMFT index. This was demonstrated in a study by Wojcik et. al. (394)

• In the presence of a short sublingual frenulum, surgical treatment is required to improve speech and nutrition

• Oral hygiene management can be aided by using a toothbrush specifically designed for patients with microcephaly, such as a Collis-Curve toothbrush.

Discussion for objective 4

Oral health care is of paramount importance to an individual's overall health. This is of particular importance for children with autism and syndromes, as they are groups that are more prone to developing oral diseases. (135) These groups of children should be examined and treated in a dental environment adapted to their needs by a dentist with the necessary knowledge and training. The results of our survey show that 50% of the doctors surveyed do not feel confident in treating children with autism and syndromes and only 23.3% are aware of the most common oral manifestations in these children and would like to educate themselves further on the subject. When monitoring parents' awareness of children's oral health, 45.8% of them rated their knowledge as insufficient. The biggest difficulties experienced by parents is finding a suitable dentist for the child's needs, as well as fear of visiting a dental office. Impaired communication, cognitive function, and other psychiatric symptoms may increase barriers to accessing timely and routine dental care for children with autism and some syndromes. Children may not be as cooperative in the dental chair and, in addition, may not be able to effectively communicate their pain or dental problems. (177) These challenges further emphasize the need for routine dental visits aimed at early diagnosis, prevention, and treatment. Radiographic evaluation of children with autism and syndromes is difficult, leading to incorrect or delayed diagnoses. A major barrier to access to care for individuals with autism and syndromes is finding a dental practitioner willing and knowledgeable enough to treat children with developmental disabilities. (177)

CONCLUSIONS

Conclusions on objective 1: Study of oral hygiene status and the frequency of dental caries in children with autism and some rare syndromes.

- Most of the examined children (72.1%) brush their teeth every day.
- Of all children examined, 159 (66.2%) brush their teeth only once a day.
- 75% of all examined children brush their teeth for 1-2 minutes.
- Complex fluoride prophylaxis is not widespread in any of the studied groups of children, with 65.4% of children using only fluoride toothpaste.
- In 116 children (48.3%), the parent is the one who brushes the child's teeth, and in 23.3% of the children oral hygiene is performed under the supervision of a parent.
- Of the examined children, 45% percent take carbohydrates as intermediate meals more than 1 time a day.
- 44.2% of children visit a dentist once a year.
- The highest plaque index was calculated in the group of children with Down syndrome - 2.40±0.72.
- In all studied groups of children, the highest plaque index was observed in the age group over 12 years.
- The highest prevalence of carious lesions d3 was observed in the age group of children <6 years in all children examined.
- The highest prevalence of D1 carious lesions was observed in the age group of children >12 years in all examined children.
- The highest prevalence of obturated teeth was observed in the group of healthy children - 0.99±0.99.

Conclusions on objective 2: Assessment of gingival and periodontal status in children with autism and some rare syndromes.

- The highest value of the gingival index was measured in the group of children with Down syndrome - 1.51±0.64.
- In the group of children >12 years old, the highest value of the index was observed in all studied groups of children.

- When calculating the values of the PSR index in the four studied groups, in the groups of children with autism, Silver-Russell syndrome and healthy children, values are observed mostly in code 0,1 and 2, which is characterized by the absence or presence of gingival bleeding and dental plaque. In children with Down syndrome, the highest prevalence is observed in code 2,3 and less in code 4.
- When measuring the depth of probing in the studied groups, the calculated average value in children with Down syndrome was the highest - 4.14±0.82.

Conclusions on objective 3: Assessment of orthodontic status and dental anomalies in children with autism and some rare syndromes.

- The highest prevalence of Angle Class II is observed in children with Silver-Russell syndrome - 36.9% of the examined children with the syndrome.
- Angle Class III prevalence was observed in 85.2% of the examined children with Down syndrome.
- 64.3% of children with Down syndrome have hypodontia, with the most frequently missing teeth being lateral incisors and second premolars.

Conclusions for task 4: To investigate the awareness of dental doctors and parents of children with autism and some syndromes regarding the oral health of these children and to prepare updated protocols and motivational materials for the prevention and treatment of children's oral diseases .

- In the conducted survey, 45.8% of parents defined their awareness as extremely insufficient.
- Half of the surveyed dentists indicated that they felt insecure when treating children with autism and syndromes.
- Due to lack of adequate professional information, these children do not receive the necessary oral health care.

VI. CONTRIBUTIONS

Original contributions:

1. For the first time in our country, orthodontic status and dental anomalies in children with autism and some syndromes are examined.

2. For the first time in our country, the oral health (intensity of dental caries, the level of oral hygiene, gingival inflammation and periodontal status) in children with Silver-Russell syndrome is examined.

Confirmed contributions with practical approach:

1. Updated protocols for the prevention and treatment of patients with autism and syndromes in outpatient settings are proposed

2. Up-to-date informative motivational materials for children with autism and some syndromes and for their parents regarding nutrition and effective oral hygiene are offered.

Confirmed contributions:

1. The higher prevalence of carious lesions in children with autism has been confirmed

2. More severe gingival and periodontal inflammation in children with Down syndrome has been confirmed

3. The lower level of oral hygiene, less frequent dental visits and higher consumption of carbohydrate foods in children with autism and syndromes have been confirmed

4. The lower level of awareness of parents regarding dental prophylaxis and treatment of their children was confirmed.

5. It has been confirmed that dentists feel uncertain about treating these patients due to lack of confidence in their knowledge and awareness.

VIII. IMPLICATIONS

When examining the prevalence of caries, periodontal problems and orthodontic deformities in children with autism and some syndromes, the following conclusions can be drawn:

• The examined children with autism showed significantly higher results on the DMFT index compared to the other two groups and the control group;

• The most carious lesions d3 were observed in the age group <6 years in all examined groups

• Most D1 carious lesions were observed in children >12 years of age in all examined groups

• The examined children showed a significantly higher degree of deformities than the control group;

• Children with Down syndrome have a severe periodontal status with bone loss, which does not always correspond to the level of dental plaque;

• Very frequent cases of hypodontia are observed in children with Down's syndrome;

• The plaque index in all studied groups shows similar values;

• The highest prevalence of Angle Class II is observed in children with Silver-Russell syndrome, and of Angle Class III in children with Down syndrome.

• The examined patients were not subject to active fluoride prophylaxis;

• Despite the parents' motivation to carry out dental treatment and prevention, the registered results show a high prevalence of oral diseases;

• Untimely sought dental care necessitates dental treatment under sedation and OA for a large percentage of the examined children;

• Dentists do not feel confident in treating these patients;

• A large percentage of physicians desire additional information related to the treatment of these patients.

• Collaboration between treating doctors and dentists is necessary in order to better conduct effective oral prophylaxis and treat

Publications related to the dissertation

1. Andreeva R, Atanasova S. Prevalence of periodontal diseases in children with Down syndrome, *Journal of IMAB* 2020; 26(4):3383-3386

2. Atanasova S, Andreeva R. Prevalence of hypodontia in children with Down syndrome, *Scripta Scientifica Medicinae Dentalis,* 2022; 8(1):50-54

3. Atanasova S. Oral manifestations in children of the Autism Spectrum Disorder: A Literature review, *Medinform,* 2022; 9(2): 1484-1490

4. Atanasova S. Prevalence of dental caries in children with Silver-Russell syndrome, *Medinform,* 2023; 10(1):1671-1676