

A Retrospective Study of Dental Caries Prevalence in 3-6 Years Old Children

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ABSTRACT

Dental caries has been examined by multiple dental specialists by registering tooth surfaces with untreated caries lesions, extracted teeth and obturated teeth. Our research aims to conduct a clinical study of the prevalence of tooth decay in primary teeth. A retrospective study was performed analysis, using medical cards of 300 children from 3 to 6-years-old in Varna, Bulgaria. Children were divided into (1-4) groups depending on age of first visit: 3-year-olds (n=50), 4-year-olds (n=50), 5-year-olds (n=100), 6-year-olds (n=100). Registration of all dental caries lesions was performed in clinical conditions, with implementation of the International Caries Detection and Assessment System (ICDAS) and DIAGNOdent Pen. The epidemiological index of decay missing filling (dmft/s) was calculated. The results were performed by processing the data with a STATISTICA Manual, Version 10.0, 2010. By application of the descriptive analysis we determine that the average value of carious lesions into the total group of participants from 3 to 6 years old (equals to: dmft = 4.40 ± 0.21 , dmfs = 6.35 ± 0.65). Patients are characterized with dmft $x \pm Sx$: (2.80 ± 0.25 in group 1), (3.00 ± 0.21 in group 2), (4.30 ± 0.29 in group 3), and group 4 with higher caries prevalence (5.10 ± 0.32). There is a strong proportional relationship between the number of carious primary teeth and surfaces.

Keywords: dental caries, dmf index, primary teeth

INTRODUCTION

Dental caries has been examined by multiple dental specialists by registering tooth surfaces with untreated caries lesions, extracted teeth and obturated teeth. This ensures three important results: ft (filled teeth) – this is the number of treated carious teeth, which shows access to dental treatment; dt (decayed teeth) – this is the amount of decayed teeth, which haven't been treated; dft (decayed and filled teeth) – this is the summation of ft and dt and it aims to determine the child's caries predisposition. In addition to the whole amount of decayed and filled teeth, the same information can be collected regarding affected tooth surfaces. Since every tooth has multiple surfaces, counting the decayed or filled surfaces is more accurate to the severity of the caries lesion development.

After conducting a study in Brasil in 2016, Correa-Faria et al. establish that the frequency of tooth decay is high and most of the children haven't received treatment. Having had a caries lesion in the near or distant past is a risk factor for developing new caries lesions. The decay frequency, established by the authors is 46,6%. The highest amount of dental caries was established in the group of children with previous caries lesions (61,1%). In 36,7% of children without a caries lesion registered in the first check up, there has been a caries lesion detected in the second epidemiological check up (Correa-Faria et al., 2016, 1).

Saravanan S. and co-authors have done a survey to evaluate the distribution of tooth decay in primary dentition in 5-year-old children. The area of their study is Pondicherry, and the amount of examined patients consists of 1009 students from both genders (527 boys and 482 girls). The dental caries was evaluated based on the status of the teeth and the need of treatment (WHO 1997). The prevalence of tooth decay in this year was 44.4% among the examined population and higher in boys. The authors concluded that primary second molars showed a higher frequency of tooth decay for both genders in the upper and lower jaw, (Saravanan et al, 2005, 2).

According to a study from China in 2011 from W. Keung Leung and C.H. Chu, the distribution of dental caries in children from Han was significantly lower than that of muslim children and tibetian children, living in the province of Qinghai. The need for treatment of tooth decay in children from Han and Qinghai was low, but their health status was unsatisfactory. The authors discovered that there was a need for basic oral and dental health care for maintaining profilactic methods in this part of China. In

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this study the examiners established the value of DMFT for the children from Han (DMFT=0,12) and the children of Qinghai DMFT=0,23. Most of the children from Han didn't have tooth decay (94%) (DMFT=0), compared to the muslim and tibetian children (82%), ($p<0.01$) (Keung Leung et al., 2011, 3).

Other authors such as ElSalhy M. and co-authors, 2017 consider that the International Caries Detection and Assessment System (ICDAS) should be used in order to establish the potential summation, which shows the tooth decay level in children. In the conducted study the target group included 2808 children 1-15 years old from Kuwait, Brasil and Spain. The primary teeth were examined with ICDAS. The general ICDAS and the average ICDAS show a correlation based on the amount of caries lesions in the different severity of tooth decay in primary, mixed and permanent dentition. From the general ICDAS results, received from 10 selectively examined surfaces in primary teeth and 12 surfaces in permanent teeth, a summarized value for the general level of caries lesion distribution has been established. ICDAS shows a correlation between the amount of carious teeth, carious enamel surfaces, carious dentin surfaces, DMFT /dmft and DMFS/ dmfs in children with mixed dentition. In the 2017 study from ElSalhy M. and co-authors the index has similar tendencies in all tooth stages. These tendencies exist only in children with high caries lesion distribution, and the population of children, included in the study is a target group with high caries risk (ElSalhy M et al., 2017, 4).

The concept of minimal intervention in dental medicine was developed from scientists, researching the development of contemporary, adhesive restorative materials. There are studies that demineralized, but not cavitated enamel and dentin can be "cured". The operative method of treating caries lesions as well as the principle of "extension for prevention", suggested by G.V. Black, is no longer acceptable and doesn't find use in the operative technique (Tyas et al., 2011, 5).

A group of scientists, such as Ana Luiza de Souza et al. in 2014 develop a new instrument for more precise assessment of dental caries – Caries Assessment Spectrum and Treatment (CAST). The team of researchers determine the reproducibility of CAST in primary and permanent dentition, which conducts two epidemiological studies in Brasil, including two age groups of children 2-6 years and 6-9 years. Based on the study they proved that the reproducibility of CAST in primary teeth in 2-6 year olds is substantial. In mixed dentition 6-9 year-olds the CAST instrument is nearly perfect. In conclusion the researchers proved that the CAST instrument can be used in epidemiological studies, including these age groups of children (de Souza et al., 2014, 6).

Dental caries still has a high prevalence among children. Scientists, researching dental caries advise that if the process is diagnosed in an early stage, it can be treated with preventive, non-operative and minimally invasive methods. There is a variety of methods for early diagnostics. One of these methods is diagnostics with DIAGNOdent Pen. Panov VI. et al., 2014. Based on the conducted study, the conclusion is that the changes in the mineralization of the enamel of primary teeth can be diagnosed with DIAGNOdent (Panov et al., 2014, 7).

AIM

Our research aims to conduct a clinical study of the prevalence of tooth decay in primary teeth.

MATERIALS AND METHODS

Materials

Subject of the study are 300 children ($n=300$) from Varna, age 3-6 years old, distributed evenly in standartised age groups with equal amount of boys and girls. The criteria for inclusion are 3-4 year old, 5-6 year old healthy children, accompanied by their parents, without systematic, gingival and oral mucous diseases, with frequent visits to the dental office. A retrospective study was performed analysis, using medical cards of 300 children from 3 to 6-years-old in Varna, Bulgaria. Children were divided into (1-4) groups depending on age of first visit: 3-year-olds ($n=50$), 4-year-olds ($n=50$), 5-year-olds ($n=100$), 6-year-olds ($n=100$). Registration of all dental caries lesions was performed in clinical conditions, with implementation of the International Caries Detection and Assessment System (ICDAS) and DIAGNOdent Pen. The aim is to determine the amount of active and reversible caries lesions.

Methods

Visually-diagnostic method, with dental mirror, light, water and air. Dental caries was determined at 2 thresholds: 1) all lesions (ICDAS 1-6) and cavitated lesions (ICDAS 3-6). The values of the initial caries were determined with DIAGNOdent Pen using laser fluorescence. The results were measured by teeth and surfaces. The children have detailed anamnesis and clinical status, with registered plaque index *OHI-S (Simplified) - J. C. Greene and J. R. Vermillion, 1964*. After detailed registration in the ambulatory cards, each of the smooth surfaces was polished and dried. Each smooth surface is examined- vestibular and oral-with visual, clinical methods, DIAGNOdent Pen, x-rays (intraoral-aproximal), Bite Wing x-rays. The values of each tooth and surface are registered. The data is achieved with clinical check ups. Each decayed (d), missing (m) and filled (f) tooth was registered with ICDAS 1-3. Non-cavitated lesions and enamel caries lesions (ICDAS 1-3) and dentin lesions (ICDAS 4-6) are examined. When determining dmft, non-cavitated lesions are included. For the registration of the oral status in children, an epidemiological card was used to evaluate the oral health status. It includes a short passport part, intraoral status, registration of the oral hygiene, evaluation of the caries risk, characteristics of the existing caries lesions (primary teeth and surfaces with/without caries lesions).

Means of observation - decayed, filled or extracted due to caries primary teeth/surfaces. The presence of one caries lesion – cavitated or non-cavitated

Observers: Doctors, specialists in pediatric dentistry

Tooth decay status: Tooth decay status of the children was diagnosed and registered according to teeth and surfaces with diagnostic threshold d1b.

Diagnostic criteria

Criteria for active caries lesions – d1a, d1b caries lesions under plaque, in predilection places, със with loss of shine and smoothness, loss of sharp borders; Criteria for stationary caries lesions - d1-2, lesions – with smooth surface, shine and sharp edges. Diagnostic scale: d1 – white enamel lesion, visible after drying; d2 – white enamel lesion, visible without drying; d3 – white enamel cavitated lesion; d4, d5 – dentin caries; d6 – dentin caries, that has reached the pulp. A – active (d1-3); NA – non-active (d1-3). Reversible caries lesions - (d1-3); Irreversible caries lesions- d4-6.

Differential diagnosis is carried out with non-carious lesions or: fluorosis, dysplasia hypomineralisata of the primary teeth, amelogenesis imperfecta hereditaria, enamel erosions of the enamel of primary teeth.

Time and place of execution of the study

The study is retrospective. Time of the study – 2015-2017.

Place of the study: The study is performed in:

- Faculty of Dental Medicine – Clinical dental office for Pediatric dentistry department, Varna
- University Medical dental center, Faculty of Dental Medicine – Varna.
- The study has a permission from the Ethics committee for scientific researches in Medical University Varna since 2015 and a written declaration of informed consent has been signed by the parents of every patient.

Registration of the data

Clinical cards, based on the World Health Organisation cards, are created for the registration of the data from the clinical research and oral-hygiene status. The registering of the values of the initial caries lesions is carried out with DIAGNOdent Pen, in order for the experiment to be precise. The three groups are standardized before the study. All children maintain oral hygiene two times a day – morning and evening. The children have three main meals and two intermediate meals with a snack and a fruit. The parents are given instructions to maintain oral hygiene two times a day and keep a dietary food regime without intermediate carbohydrate intakes. The check ups for the study are done by pediatric dentists. The results are measured by teeth and surfaces. Laser fluorescence diagnostics was applied and the results were measured with DIAGNOdent Pen.

Activity and reversibility of the caries lesions

Subject of observation: Dental caries.

Objects of observation: Children with high caries risk. The data was gathered after each check up and was registered in a specially devised Statistic card for people with dental caries, which is registered in an electronic table afterwards.

Data Analysis

Statistical methods: For a statistical analysis of the data a specialized packet STATISTICA 10.0. (StatSoft, Inc., STATISTICA Manual (Data analysis software system), Version 10.0, 2010) was used.

RESULTS

After a descriptive analysis we have gathered that the average frequency of dental caries in the age group 3-6 years-old is , It = 4,40 ± 0,21. The average frequency of dental caries in the different age groups shows, that the highest prevalence of dental caries is in 6 year olds (dmft = 5,10±0,32). For 3 year olds dmft = 2,80±0,25, for 4 year olds dmft = 3,00±0,21, for 5 year olds dmft = 4,30±0,29 (Table 1). The comparative analysis of the caries activity in the dentition shows that there is a significant difference between the caries activity in children with different tooth count (F = 27,48, p < 0,001). With biggest caries activity are children with 19 primary teeth (4,21), and with lowest – children with 20 primary teeth (1,74), (Figure 1, Table 2).

Table. 1. Dental caries lesions prevalence in primary teeth, dmft in 3-6 year-old children

| Age in years | Persons | dmft $\bar{x} \pm S_x$ | u | P |
|--------------|---------|------------------------|------|--------|
| 3 | 50 | 2,80±0,25 | 1,02 | > 0,05 |
| 4 | 50 | 3,00±0,21 | 1,01 | > 0,05 |
| 5 | 100 | 4,30±0,29 | 1,03 | > 0,05 |
| 6 | 100 | 5,10±0,32 | 1,09 | > 0,05 |
| Total | 300 | 4,40±0,21 | 1,15 | > 0,05 |

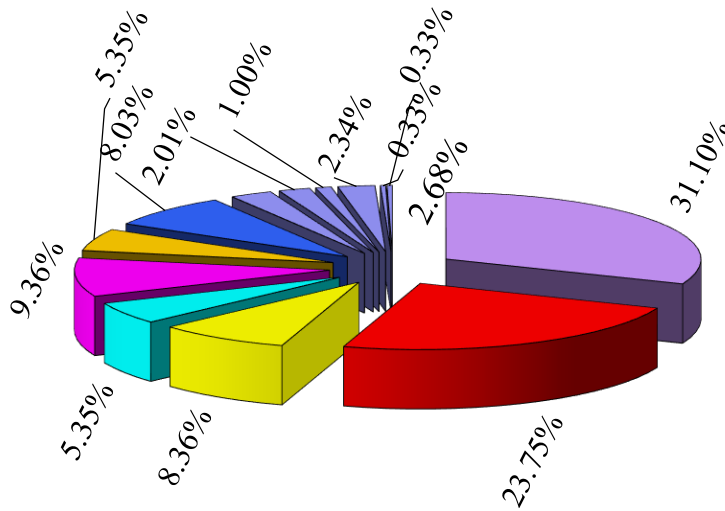


Fig. 1. Age dynamics of the dmft index with different diagnostic threshold – (d1-3). Count and relative share of dental caries by teeth

Table. 2. Age dynamics of the dmft index with different diagnostic threshold – (d1-3). Count and relative share of dental caries by teeth. Total count of caries lesions and dmft index

| Total count of children | Intact teeth | 1 decayed tooth | 2 decayed teeth | 3 decayed teeth | 4 decayed teeth | 5 decayed teeth | 6 decayed teeth | 7 decayed teeth | 8 decayed teeth | 9 decayed teeth | 10 decayed teeth | 11 decayed teeth | 12 decayed teeth |
|-------------------------|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|
| Number of children | 93 | 71 | 25 | 16 | 28 | 16 | 24 | 8 | 6 | 3 | 7 | 1 | 1 |
| Percent % | 31.10 % | 23.75 % | 8.36% | 5.35% | 9.36% | 5.35% | 8.03% | 2.68% | 2.01% | 1.00% | 2.34% | 0.33% | 0.33% |

The dmft index shows the average count of teeth, affected by caries for one child. The hystogram shows the average count of teeth, affected by caries for different age groups. The total count of registered children is 300. With highest frequency are children with one caries lesion (n=71). There are children with more caries lesions, the sum of which is (10,11 and 12 decayed teeth), (Table 1). The different extent of diagnostics shows presence of reversible stages of caries process. There is sufficient potential for applying non-operative and preventive treatment in primary teeth. Diagnostics also shows the presence of cavitated and irreversible caries lesions, that require operative and invasive treatment with restorative techniques and materials. With the statistical analysis we have determined that the strong proportional relation between the number of decayed teeth and decayed surfaces ($r=0,836$, $p<0,001$), (Table 1 and 3).

Table. 3. Dental caries lesions prevalence in primary teeth based on surfaces, dfs for 3-6 year-old children

| Age in years | Persons | dfs $\bar{x}\pm Sx$ | u | P |
|--------------|---------|---------------------|------|--------|
| 3 | 50 | 3,80±0,98 | 1,02 | > 0,05 |
| 4 | 50 | 4,40±0,61 | 0,51 | > 0,05 |
| 5 | 100 | 6,58±0,79 | 0,83 | > 0,05 |
| 6 | 100 | 8,08±0,55 | 0,79 | > 0,05 |
| Total | 300 | 6,35±0,65 | 1,15 | > 0,05 |

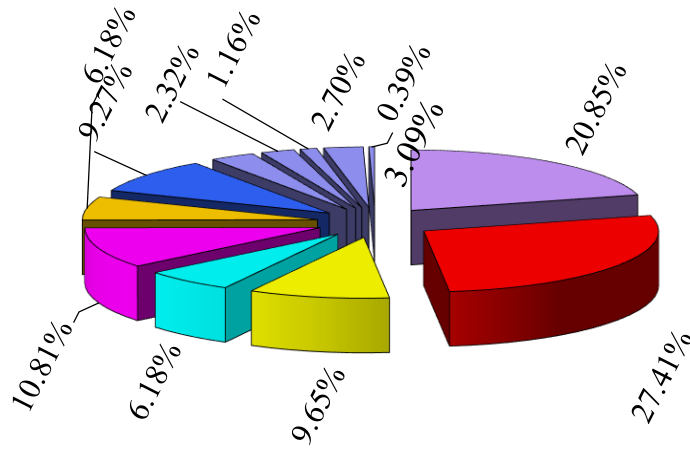


Fig. 2. Number and relative share of dental caries based on surfaces in 3-6 year-old children

Table. 4. Number and relative share of caries lesions based on surfaces. Total count of caries lesions and dfs index

| Total number of children 300 | Intact surfaces | [1-2] surfaces | [3-4] surfaces | [5-6] surfaces | [7-8] surfaces | [9-10] surfaces | [11-12] surfaces | [13-14] surfaces | [15-16] surfaces |
|------------------------------|-----------------|----------------|----------------|----------------|----------------|-----------------|------------------|------------------|------------------|
| Number of children | 54 | 71 | 25 | 16 | 28 | 16 | 24 | 8 | 6 |
| Percent% | 18.06 % | 23.75 % | 8.36 % | 5.35 % | 9.36 % | 5.35 % | 8.03 % | 2.68 % | 2.01 % |

Table 4 and Fig. 2 determines the average count of decayed surfaces in different age groups, as well as the percent of affected surfaces. The ratio doesn't vary significantly in the previous figure 1, (Table 2). The percent ratio of lesions is also determined. The results from the study of caries lesions on surfaces show, that caries lesions involving one or two surfaces prevail (23,75%). With highest frequency are caries lesions on several surfaces in primary teeth – 7,8 surfaces (9,36%), 11-12 surfaces (8,03%).

DISCUSSION

In our study the results show, that with increase in age in children, there is an increase in the number of caries lesions. Every diagnostic threshold reveals a larger count of affected surfaces. The descriptive analysis shows, that the average frequency of caries lesions in the age group 3-6 year-olds is $It = 4,40 \pm 0,21$. The average frequency of dental caries for different age groups, shows that the highest prevalence is observed in 6 year-olds ($dmft=5,10 \pm 0,32$). In primary teeth we can observe reversible stages of the caries process. All reversible lesions d1a, d1b, d2 can regress or become stationary, by lowering the accumulated pathology and maintaining exogenous fluoride prophylaxis, remineralizing therapy, dietary food regime and excellent oral hygiene with fluoride toothpaste, suitable for the age group.

In our study we have established a strong direct ratio relation between the number of decayed teeth and decayed surfaces ($r = 0,836, p < 0,001$). The different degree of diagnostics shows the presence of reversible caries lesions d1a, d1b и d2. There is a sufficient potential for applying non-operative preventive treatment in primary teeth (Damyanova D et al., 2018, 2017, 2016, 8,9,10). Diagnostics show the presence of cavitated and irreversible caries lesions d3 and d4, which require operative treatment.

Doichinova L, Peneva M, achieve similar results in 2015 for the children in Sofia after doing a research. The authors conclude that the acquired results show the need for preventive treatment for improving the oral health of children in their researched region (Doichinova L et al., 2015, 11).

According to Klein H. and Palmer C. in 1938 the intensity of dental caries prevalence in children can be evaluated based on the index of the summation of the decayed, extracted (missing) and filled teeth and surfaces – DMF. Based on the results, a child can be placed in one of three risk groups – low caries risk, up to 2 DMFT (decayed, missing and filled teeth); medium caries risk, up to 4 DMFT and high caries risk – above 4 DMFT (Klein H, Palmer C, 1938, 12). The instrument of evaluation of the caries and parodontal disease risk is created in Bulgaria, in the department of Pediatric Dentistry, Faculty of Dental Medicine, Sofia by Rashkova M, Peneva M and Doychinova L, 2008. It is easy to use and a great help for pediatric

dentists, helping them improve early diagnostics and receive results in early treatment (Rashkova M, Peneva M, Doychinova L, 2008, 13).

In 2015 Doichinova L et al., conduct a study with patients 6-12 years old with carbohydrate intake as a risk factor. The research team from the Faculty of Dental Medicine, Sofia receive results that the children with high caries risk are highest percent $n=54$ (54%) and prefer carbohydrate rich foods. They have the highest DMF(T+t)= 5,2. For the other children with medium caries risk $n = 26$ (26%) и DMF(T+t) = 3,1 and for the children with low caries risk $n = 20$ (20%) и DMF(T+t) = 1,8. The observed high levels of DMFT in 54% of the children is a logical result, based on the frequent intake of sweet foods and drinks for a long period of time, which increases the production of acids from the microorganisms in the plaque, which is a leading etiological factor for tooth decay development. Dentists use health promotion and education to control the intake of carbohydrates, as well as encourage non-cariogenic diets in order to improve the oral health status. (Doichinova L et al., 2015; Dimitrova-Haruel, 2004, 14, 15).

According to the World Health Organisation, the diet has a main role in the prevention of oral diseases, including caries lesions, tooth erosion, defects in development, oral mucosa pathology and periodontal diseases (Moynihan PJ, 2005, 16,17). Caries pathology is a combination of aesthetic and functional problems. The incidence and severity of the loss of height of the interdental papillae increases with age (Georgieva Ir et al, 2017, 18).

On the other hand, an effective method to prevent caries lesion development is consumption of water, containing fluoride, combined with lowering the intake of saccharose and lactose (Moynihan PJ, 2005,19). Nowadays the excessive intake of simple carbohydrates is a serious health issue, which has an unfavorable impact on the dental status (Moynihan P, Petersen PE, 2004, 20).

Dental caries is a painful, expensive to treat disease and it can have a harmful impact on the dentition (Dimova-Gabrovska M et al., 2016, Dimitrova D et al., 2018, 21, 22,23). Some of the authors, Belcheva A. and co-authors in 2014, use operative treatment for D₃ caries lesions in children 6-12 years old in Plovdiv, Bulgaria, creating cavity preparations with Er: YAG Laser and conventional burs (Belcheva A. et al, 2014, 24).

Granville-Garcia A.F. et al. in 2018 conduct a cross study, including 769 children in schools, located in northeastern Brasil. Among the parents and caregivers of the children, the low sense of coherence led to a worse way of life and oral health. For the children the psychological aspect didn't have an impact on their way of life and oral health. The researchers concluded that for both the parents and the children, toothache is an oral condition, which has a negative impact on the way of life and the oral health (Granville-Garcia A.F et al., 2018, 25).

Definitions of Terms Related to the Dental Caries Lesion- Caries Lesion (88%). Caries lesion is the clinical sign of caries. Caries lesions can be categorized according to their anatomical location on the tooth (coronal or root,cementum surface), their severity (non-cavitated, cavitated), depth of penetration into the tissue (in enamel, dentin, pulp), and their activity status (active, inactive), (26).

CONCLUSION

There was a significant difference in the intensity of caries for children with different number of primary teeth in their dentition. There is a strong proportional relationship between the number of carious primary teeth and surfaces.

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