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Prevalence of Developmental Defects of Enamel Among Children With Down Syndrome in Damascus, Syria

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Abstract

Background: Down syndrome (DS) is a disorder which has conditions that may contribute to the developmental defects of enamel (DDE) etiologies. The aim of this study was to assess the prevalence of DDE among children with DS.

Methods: This study cross-sectional observational study examined a total of 88 children with DS and 87 healthy children. A modified DDE index for screening surveys was employed in this regard. Demarcated opacities, diffuse opacities, dysplasia, and combinations between types were recorded, and finally, data were analyzed by chi-square and Mann-Whitney U tests using SPSS software.

Results: The prevalence of enamel defects in DS and control groups was obtained as 45% and 34%, respectively, with no statistically significant differences between the groups (P=0.139). The mean number of teeth with DDE was 2.48±3.79 and 1.09±2.11 in the DS and control groups, respectively. Based on the results, statistically significant differences were found between DDE means (P=0.009). Demarcated opacities were the most frequent type of enamel defects in both groups. Eventually, a statistically significant relationship was observed between diffuse opacities and DS (P=0.000).

Conclusions: In general, DS had no influence on DDE prevalence; however, it increases affected dental units. Diffuse opacities are more frequent among children with DS compared to healthy children. Further studies are required on the DDE prevalence in Syria.

Keywords: Down syndrome, Enamel defects, Children, Opacities

Background

Down syndrome (DS) is the most common genetic disorder with an incidence of 1 per 374 live births (1).

Children with DS have shown a high prevalence of dental anomalies containing hypodontia, shape anomalies, supernumerary teeth, and taurodontism (2). Further, they suffer from digestive anomalies, metabolic disorders, nutrient deficiencies, and intellectual disabilities (3,4).

The inadequate diet and digestive system dysfunctions cause vitamin and mineral deficiencies (vitamin A, C, and B groups, calcium, zinc, and the like) in these children (5,6).

Studies have reported that the above-mentioned conditions contribute to the occurrence of enamel defects (7-9).

Moreover, some studies found an association between mental retardation and enamel defects as a result of the correlation between the development of enamel and the development of the brain (10,11).

Dental enamel is a unique non-regenerative tissue and, changes during its formation are permanent (12). Enamel formation is classified into three extensive stages, namely, matrix formation, calcification, and maturation (13).

Generally, enamel hypoplasia is the quantitative reduction of the enamel resulting from alternations in the matrix formation stage, while opacities result from alternations in calcification or maturation stages (14,15). Previous processes are affected by genetic and environmental factors.

Accordingly, DS and developmental defects of enamel (DDE) have multiple factors in common. Unfortunately, there is little information about the oral health of people with DS in Syria.

To our knowledge, no study has so far assessed the prevalence of DDE among children with DS in particular.

In addition, DDE are responsible for many clinical problems, including tooth sensitivity, aesthetic impairment, and increased risk of dental caries (16). Investigating DDE in those children can improve our understanding of potential etiologies and aid in the early implementation of adequate management.

Therefore, this study sought to assess the prevalence of
DDE in children with DS and compare the findings with matched healthy children.

Materials and Methods
This cross-sectional study (April-August 2019) included 88 individuals with DS aged 8-15 years from 5 special needs centers around Damascus and 87 matched healthy children.

Children in the DS group had confirmed diagnoses by specialists. Healthy children were selected from schools in the same district, were matched with DS children in terms of age and gender, and suffered from no chronic disease. Children with active infectious diseases or other health conditions needing extra precautions for their health were excluded from the study. Extremely uncooperative children and children undergoing orthodontic treatment were excluded as well.

A modified DDE index for screening surveys was employed to assess DDE (17). The World Health Organization's guidelines were taken into consideration in the methods used in this study (18).

To calibrate the examiner, photographs with all possible conditions for assessment were displayed twice on ten different days. Then, 15 patients with DDE were evaluated by another experienced examiner. After the study initiation, all examinations were performed by a single examiner.

Examinations were conducted under an artificial headlight using a plane mirror with the patient's head against the wall. The Tell-show-do technique was employed to facilitate the examination. Defects on primary and permanent teeth were recorded in this phase.

Sterile gauze was used to dry teeth and clean debris when necessary. Defects under 1 mm were ignored, and demarcated and diffused opacities, dysplasia, and combinations between types were recorded on a pre-designed form.

Demarcated opacities can be defined as an enamel defect that has clear borders with adjacent normal enamel. However, diffuse opacities have no clear borders with adjacent normal enamel and can appear in a linear, patchy, or continuous formation. In addition, hypoplasia is defined as a deficiency in the thickness or quantity of enamel and can appear as grooves, pits, or larger areas of missing enamel (19).

Data were analyzed using IBM SPSS Statistics, version 26. Mann-Whitney U and chi-square tests were implemented to discover the relationships between variables.

Results
A total of 88 children with DS and 87 healthy children were included in this study. The prevalence of enamel defects in the study group was 45%, while it was 34% in the control group with no statistically significant relationship between the groups ($P = 0.139$, Table 1).

The DDE prevalence was higher in mixed dentition in the study and control groups (31% and 33%, respectively) compared to the permanent dentition stage in both groups (24% and 32%, respectively). Moreover, there was no significant relationship between the groups ($P = 0.171$) in mixed and permanent dentitions ($P = 0.692$, Table 2).

The mean number of teeth with DDE in the study group was $2.48 \pm 3.79$, which was higher than that of the control group ($1.09 \pm 2.11$). There was a statistically significant relationship between the groups ($P = 0.009$, Table 3).

The demarcated opacities were the most frequent type of DDE in the DS and control groups, and the percentage rate was 42% and 34%, respectively. However, the prevalence of diffuse opacities in the DS group was 22%, while that of the control group was only 2% ($P = 0.000$, Table 4).

Discussion
The prevalence of DDE varies between countries due to environmental influences such as adverse events during early childhood (20,21). Malnutrition has been reported to have an effect on tooth formation, especially during

### Table 1. Demographic Characteristics and Prevalence of DDE in the Sample

| Variable          | Study Group | Control Group | $P$ Value |
|-------------------|-------------|---------------|-----------|
| Gender            |             |               |           |
| Male              | 47          | 41            | 0.406*    |
| Female            | 41          | 46            |           |
| Age (y)           |             |               |           |
| 8-11              | 49          | 48            | 0.946*    |
| 12-15             | 39          | 39            |           |
| DDE               |             |               |           |
| None              | 48          | 57            | 0.139*    |
| One defect or more| 40          | 30            |           |
| Total             | 88          | 87            | 100.0     |

Note: DDE: Developmental defects of enamel.

### Table 2. Prevalence of DDE in Mixed and Permanent Dentition

| Variable          | Study Group | Control Group | $P$ Value |
|-------------------|-------------|---------------|-----------|
| Mixed dentition   |             |               |           |
| None              | 27          | 29            | 0.171*    |
| One defect or more| 29          | 18            |           |
| Permanent dentition|            |               |           |
| None              | 21          | 28            | 0.692*    |
| One defect or more| 13          | 14            |           |
| Total             | 88          | 87            | 100.0     |

Note: DDE: Developmental defects of enamel.

### Table 3. Differences in the Mean Number of Teeth With DDE Between the Sample Groups

| Variable          | Study Group | Control Group | $P$ Value |
|-------------------|-------------|---------------|-----------|
| Number of teeth with DDE | 2.48          | 1.09            | 0.009*    |

Note: SD: Standard deviation; DDE: Developmental defects of enamel.

* Mann-Whitney U test.
early childhood (7,22). Socioeconomic status, pre- and peri-natal events, as well as maternal nutrition during pregnancy have also an effect in this regard (23,24).

Discovering relationships between DDE and possible etiologies supports understanding predispositions and allows taking into consideration early appropriate approaches. Previous studies reported that DDE can cause tooth sensitivity, early childhood caries, malocclusion, and aesthetic complications (20,25,26). Therefore, the current study aimed to evaluate DS correlation with DDE.

The DDE prevalence was 45% and 34% in the DS and control groups, respectively, with no statistically significant relationship between the groups. The previously mentioned findings are in line with those of Nogueira et al (27). They assessed DDE among cerebral palsy (CP) individuals and found no statistically significant relationship between CP and controls. Furthermore, they concluded that etiological factors in CP occurrence had no effect on DDE. In another study, Erika et al indicated that the prevalence rate of DDE was 40.2% and 52% in primary and permanent dentitions, respectively (30).

Although DS as a disorder has conditions that contribute to the etiological factors of DDE, there is no evidence confirming that DDE occurred more often among DS. However, the number of DDE teeth was significantly higher in DS compared to matched healthy subjects. This leads us to believe that DS has no effect on the prevalence rate of DDE, but it increases affected dental units. Likewise, Moraes et al reported that individuals with DS had a variety of dental anomalies and often more than one anomaly in the same patient (2).

Our findings represented that the most frequent type of enamel defect was demarcated opacities in both groups. However, in the study of Lin et al, enamel hypoplasia was the most frequent type of enamel defect (31). On the other hand, our results conform to those of the study by Erika et al, indicating that the isolated demarcated opacities were the most recurrent type of DDE in intellectually disabled children (11).

Diffuse opacities are considered to be the characteristic of the DS group, although the tap water of most zones of Damascus has low fluoride concentration rates. The control group had a low prevalence of diffuse opacities, which were located in the same residential area of DS institutes. Familial habits and nutritional supplement intake may have a role in this respect. Nogueira et al concluded that the most prevalent DDE type among CP patients was diffuse opacities (27). Additionally, Gerreth et al suggested that numerous detected developmental defects in children with intellectual disability were caries-resistant which can be due to excess fluoride consumption during childhood as a result of poor control over the swallowing reflex (10).

Limitations of our study are being less interested in differences between white and yellow opacities than demarcated and diffuse opacities. However, differentiation between opacities’ color is less important than differentiation between demarcated and diffuse opacities (32). The included DS children were selected only from special needs institutes because it is difficult to obtain DS subjects unless they are integrated into society.

We suggest promoting oral hygiene through educational programs aiming at educating parents or caregivers on oral hygiene practices and dietary counseling and encouraging them to regularly visit dental specialists.

Conclusions
The findings of this study revealed no relationship between children with DS and healthy children in terms of the prevalence of enamel defects, even though DS children had an increase in the mean number of teeth with enamel defects. Further studies are necessary on the DDE prevalence in Syria.

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