Original Article

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Evaluation of correlation between chronological age and delayed eruption in Down syndrome - An Original Research

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ABSTRACT

Purpose: To assess the correlation between Down syndrome and delayed eruption of permanent teeth, in relation to the chronological age, in children with Down syndrome. Methods: The study group included 80 children in mixed dentition, of ages between 6 and 12 years: 30 children with Down syndrome and 50 healthy children. Clinical and radiological examinations were done, focusing on the relation between dental age and chronological age of all patients. **Results:** The presence of Down syndrome in children has a notable influence ($p < 0.001$) on the delayed eruption of permanent teeth, contemplating the chronological age, compared to healthy children. The weighted average of the delay in our study was 1.20. **Conclusions:** It is obligatory to monitor children with Down syndrome for an extended period of time, so as to ensure a high quality of life and to enhance their health as much as possible.

Keywords: Children, Chronological age, Down syndrome, Dental eruption, mixed dentition.

INTRODUCTION

Down's syndrome is also denominated as trisomy 21, trisomy G, and mongolism.[1] It is an autosomal disorder with an incidence of 1/700.[2] It is the most frequent genetic form of intellectual disability. It represents the main cause of certain medical conditions and problems. The incidence of this syndrome is of approximately 1:800 in living newborns, the risk occurrence being in strong connection with mother's age.[3] The first description of a child who had Down's syndrome was provided by Esquirol in the year 1838.[4]

The physical appearance of a child with Down syndrome is typical, the diagnosis being accepted on the basis of associating certain modifications. The craniofacial features involved in Down syndrome include brachycephaly, short neck, flat occiput, flattened facial appearance, neuromuscular hypotonia, generousnuchal skin, hypoplastic maxilla, small nose associated with a low nasal bridge, upward-slanting palpebral fissures, flat nasal bridge, small and anteverted nares, ogival palate and tong with fissures and papillary hypertrophy .[5] The ears are smaller, lobes are hypoplastic or absent; there are epicanthal folds, and the child has hearing difficulties. [5] Children with Down syndrome have a decreased brain volume than others. Previously unreported reductions in parietal cortex, temporal lobe and improper neural development might be the cause for particular features of mental retardation that in some way results from this syndrome. [6] Computerized anthropometry is mostly used for quantitative examination of the facial characteristics of Down syndrome.

The frequent oral complications in these children are mouth breathing, macroglossia, open-bite, angular stomatitis, hypodontia, microdontia, fissured tongue and lips, malocclusion, low incidence of dental caries and delayed eruption of primary and permanent dentitions. [7] Eruption is an essential parameter of morphological development, and can be determined by clinical examination or radiographs.[8] Chronological age is the age of an individual expressed in years, while dental age is the age determined by the dentition.[8] Delayed eruption in Down's children could influence primary and permanent teeth. For deciduous dentition, there is a delay in timing and sequence. The chronologic sequence of eruption in Down's syndrome is not different from others. The teeth least affected are upper and lower first molars and central and lateral incisors. [8] Asymmetries between sides of the jaw affect the canines and asymmetry is less frequent between 7 and 9 years of age and frequent between 10 and 14 years.[8]

The causes of delayed eruption in children with Down syndrome are usually unknown, due to incomplete understanding of the factors that intervene in the normal eruption process. Nevertheless, it is influenced by genetic factors. There are evidences suggesting that the rate of eruption is influenced by pulp vascularization of conjunctive tissue.[9] Decreased peripheral circulation might be a contributing factor in delayed eruption. It can also be due to the delayed growth and development of the

maxilla, mandible and aspects which are common characteristic to this syndrome.[9] Other local factors, like traumas, carious or periapical lesions of deciduous teeth, can also lead to delayed eruption. The relationship between Down syndrome and dental eruption has been less approached.

The aim of our study is to evaluate the relation between Down syndrome and delayed eruption of permanent teeth, in relation to chronological age, in this category of children.

METHODS

The study group included 80 children in mixed dentition, of ages between 6 and 12 years: 30 children with Down syndrome and 50 healthy children. Clinical and radiological examinations were done, focusing on the relation between dental age and chronological age of all patients. Clinical and radiological examinations were done, and the succession in permanent teeth eruption in all the quadrants of oral cavity, along with eruption disorders were evaluated. The data obtained were recorded in dental examination sheets of patients in both groups. For each patient in the study, the following were recorded: family history, pathological and dental personal history, state of dentition, growth indices (dental age , chronological age).

The study was carried out between the year 2016 and 2017. The examinations were consented by the parents of children, the university management. Dental age was determined by clinical examination, depending on the absence, presence, and number of permanent teeth in oral cavity. To determine the statistical relation between the presence of Down syndrome and delayed age of tooth eruption compared to the chronological age, we used statistical calculus of correlations and regressions. Using the SPSS software, we analyzed the correlation factor between the exixtence of the disease and delay in tooth eruption. To ensure that this relation is not affected by factors linked with multicollinearity, we carried out a test on variation inflation factor (VIF), which led to results that were below the maximum acceptable limit of 10, and hence data have been accepted without much problems generated by multicollinearity. Secondly, in order to evaluate the influence and statistical significance of adopted model, we used a simple ordinary least squares regression, which allows a valid measurement of the statistical relation between independent and dependent variables. The statistical model used the pattern of some fixed effects, which are definitely adequate for the relation studied in this particular research. The level of statistical significance was set at $p < 0.05$.

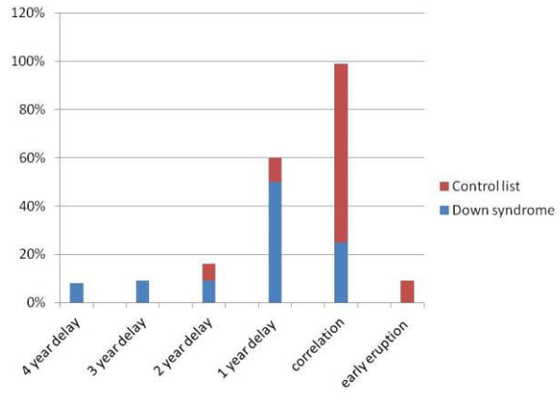
RESULTS

After the clinical and radiological examinations of patients of the study group, we observed the following: 30 of the patients with Down syndrome, 10 children (33.33%) presented a concordance between dental age and chronological age. The highest number of children, 20 (66.66%), presented a year difference between the two ages. The greatest discrepancy of a 4 year difference between two ages appeared in 4 children (8%), 8 children (17%) presented difference of 3 years (n = 3) and 2 years (n = 3) respectively, between dental age and chronological age.

The examinations which were carried out on the control group indicated that 45 children (74.13%) presented a correspondence between dental age and chronological age. In 7 children we observed a delay in tooth eruption of 1 year,

while 5 children presented a 2-year delay. Early eruption was observed in 6 children (Figure 1). In total, 25 children (75%) from the patients with Down syndrome, and 10 children (17%) from the control group presented delayed eruption, the difference being statistically significant. The correlation between dental age and chronological age was assessed in 10 children (33.33%) with Down syndrome and in 43 children (74.13%) from the control group.

Analyzing the correlation factor between presence of Down syndrome and delay in teeth eruption, we obtained a correlation coefficient of 0.609, which is definitely considered an average-to-high value of the relation between the two variables. With the statistical calculus of regression, a predilection value of R2 equal to 0.37 and statistical correspondence of significance model at the level of 99% resulted. Regarding the direct relation between presence of Down syndrome in children and delay in tooth eruption, compared with chronological age, we have noticed a positive coefficient relation, statistically significant at the level of 99% ($p < 0.001$). The weighted average value of this discrepancy in the study group was 1.20 years.



DISCUSSIONS

The results of this study, significant from a statistical point of view, are correlated to other studies. In a study on 41 children

with Down syndrome aged between 6 and 10 years, Asokan *et al*. also obtained a statistically significant value, which mentions a delay in tooth eruption in study group (p <0.004).[10] Many authors have evaluated the accuracy of Demirjian's method and their results vary. Some authors even found that Demirjian's method was more accurate on the studied population (Bagherpour et al., 2010; Hedge et al., 2002; Baghdadi et al., 2012) while others highlighted various drawbacks of the method (Nik-Hussein et al., 2011; Cruz-Landeira et al., 2010).[11,12,13,14,15]

A similar study was conducted by Diz and Limeres, in which they assessed the discrepancy between chronological age and dental age in children with Down syndrome, and cerebral palsy with intellectual disability, respectively. The group of children with Down syndrome comprised of 37 patients, with ages between 3 and 17 years: 3 in 10 patients presented delay of 2 years, 2.5 years, and 3 years, respectively , with p value of 0.02 (95% level of confidence). The results referred only to female patients, since the males included in that study did not present statistically significant results.[16] In Ogodescu's study, girls presented an increased dental age in the groups 5.5 - 6.4 years and 11.5 - 14.4 years. In boys, Ogodescu found advanced chronological age in most age groups except groups of lowest (5.5-6.4 years, 6.6-7.4 years) and highest (13.5-14.4 years) ages.[17] We compared our results with the results of studies conducted on Caucasian samples, as well as studies Black samples. There are several studies in which dental age was less advanced than chronological age. A study on Turkish children from the Anatolia Region showed a delayed dental age by -0.38 years in whole group, 0.33 years in girls and -0.48 years in boys (Karatas et al., 2012).[18] Leurs revealed that dental age was lower than chronological age by -0.6 years in girls and 0.4 years in boys (Leurs et al., 2005) in Dutch sample.[19] Similar studies of delayed dental age were reported in India by Serene Koshy (-2.82 years in girls and - 3.04 years in boys) and Hedge (-0.04 years in girls and -0.14 years in boys) (Hedge et al., 2002; Serene Koshy et al., 1998).[12,19] In a sample of Sudanese children, Rizig found an underestimation of age (1.42 years in girls and 0.70 years in boys) (Rizig, 2013).[20]

Studies in which dental age was more advanced than chronological age were from Nordic countries. In Sweden, Mornstad found differences between randing between 0.4 and 1.8 years in boys and between 0.5 and 1.8 years in girls (Mornstad et al., 1995).[21] Nykanen evaluated that in a sample from Norway, dental age was ahead by 0.2 years in boys and 0.3 years in girls. [22] In Finland Nystrom found a difference of 0.7 years in boys and 0.9 years in girls (Nystrom et al., 1986).[23] Similar results were obtained by Rozylo-Kalinowska in Poland where both girls and boys were more advanced than French-Canadian children (Rozylo-Kalinowska et al., 2008).[24] The differences observed in the various studies between the dental maturity and chronologic age as measured by the Dermijan method can be because of the variability of sample structure regarding its size, age, sex, ethnicity, nationality, socio-economic status , diet of patients, the method of statistical analysis used and/or the examiner's subjectivity (Rizig, 2013; Hedge et al., 2002).[12,20]

Possible differences regarding the delay interval in eruption can be due to factors such as regional differences, different structure of study group, local and general factors. Among the comorbidities of study group, a large number of patients presented mental handicap and asked a personal assistant. The development of dental-facial complex is an extremely significant indicator for the orthodontist as well as for the maxillofacial surgeon. Estimations regarding the stage of development of dental structures can determine the optimal time for starting the orthodontic treatment. These estimations can help the doctor decide on the surgical removal of temporary teeth. A delay in eruption can hence affect the precision of diagnosis, as well as decision on the right treatment plan. Therefore, delay in dental eruption can have a significant impact on health.

CONCLUSIONS

The presence of Down syndrome in children has a direct influence on the delay in eruption of teeth, in relation to chronological age, compared with children who do not suffer from this syndrome. It is therefore, necessary to monitor children with Down syndrome for an extended period of time, to identify abnormalities in their dental eruption, to ensure a high quality of life and to optimize their health as much as possible.

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