

ASSESSMENT OF OCCLUSION IN PRIMARY DENTITION AMONG PRESCHOOL CHILDREN WITH DOWN SYNDROME

Fares S. Al-Sehaibany*

ABSTRACT

Aim: To assess the occlusion in primary dentition among Saudi preschool children with Down syndrome (DS).

Methods: This cross-sectional study was conducted over 10 months on 124 Saudi preschool children with DS aged 3-6 years with a complete set of primary dentition. The children were randomly selected from DS centers in Riyadh, Saudi Arabia. The primary molar relationship, canine relationship, overbite, overjet, posterior crossbite and scissors bite were recorded in centric occlusion.

Results: The mesial step was the most observed (60.5%) molar relationship among the participants ($P=0.001$). Moreover, the Class III canine relationship represented 62.9% of the sample ($P=0.001$). More than one-third of the sample (39.5%) had an edge-to-edge overbite followed by an anterior open bite in 28.2% of the sample ($P=0.027$). The majority of the children examined (48.4%) had an edge-to-edge overjet followed by reversed overjet (anterior crossbite) in 27.4% of the sample ($P=0.001$). One-third (33.8%) of the children had a posterior crossbite.

Conclusion: The results of this study are considered to be of importance to pediatric dentists making treatment decisions for preschool children with DS.

KEYWORDS: Occlusion, Primary dentition, Down syndrome

INTRODUCTION

Down syndrome (DS), or Trisomy 21, is a genetic disorder that results in intellectual impairment, typical craniofacial features and a wide spectrum of phenotypic abnormalities.¹ In 1866, John Down described some of the characteristics of

the syndrome, which now bears his name.¹ Down syndrome is an easily recognized, congenital, autosomal anomaly characterized by generalized growth and mental deficiency.² Occlusal anomalies have considerable impact on children with DS, causing problems in their daily activities, including their physical appearance oral functioning, such as

*Associate Professor, Department of Pediatric Dentistry and Orthodontics, College of Dentistry, King Saud University, Riyadh, Saudi Arabia.

chewing, swallowing, and speaking. Generally, the most frequent malocclusions stem from variations in anteroposterior, vertical and transversal occlusion, identified mainly as anterior open bite, anteroposterior crossbite, and proclination of the anterior teeth.^{3,4}

The medical advances and the improved educational system, as well as recognition of oral health and dental occlusion, lead to children with DS to be presented with improved and promising overall health and oral health, specifically.⁵ According to Niazi et al in 1997, the overall birth prevalence rate of DS in Saudi Arabia was 1 per 554.⁶

The occlusion in primary dentition, which varies among populations, plays a role in determining the occlusion of permanent dentition.⁷⁻⁹ Research on the occlusion in primary dentition has been conducted among children of different age groups in various regions of the world.⁷ However, Vigild¹⁰ reported 54% of the children examined with DS had mesial molar occlusion, 38% had an anterior open bite and 65% had an anterior crossbite. Ferreira et al¹¹ stated that the most prevalent occlusal relationship between primary canines and primary molars among Brazilian children without DS was Class I. In a study conducted on Australian children without DS in a three to six-year-old age group, the rate of the class I relationship was observed to be lower in the primary canines than in the primary second molars.¹²

The study of Winter et al¹³, showed that a mesial step molar relationship and Class III canine relationship were common in children with DS compared to children without DS, which was attributed to anteroposterior maxillary deficiency, musculoskeletal abnormalities and altered cranial-base relationships. The study of Mestrovic et al¹⁴ on 2-36-year-old subjects with DS revealed 43.8% of the subjects had a class III molar relationship and 8.7% had an anterior open bite.

Studies investigating the occlusion in primary dentition among preschool children with DS are relatively rare. Therefore, the aim of this study was to assess the occlusion in primary dentition among Saudi preschool children with DS.

MATERIALS AND METHODS

This cross-sectional study was based on a clinical examination of 124 Saudi preschool children aged 3-6 years from Riyadh City, the capital of Saudi Arabia. The study protocol and consent form was approved by the Research and Ethical Committee of Human Studies at College of Dentistry Research Center, King Saud University. The sample was recruited from randomly selected DS centers from a list obtained from the ministry of Education in Riyadh, Saudi Arabia using the stratified cluster random sampling technique. The study was conducted over a period of 10 months (from September 2016 until June 2017). Letters explaining the nature of the study and informed parental consent for the child's participation in the study were sent to the parents through DS centers' principals.

Clinical examination was conducted in an upright position at the center's facility while the child was seated on a regular chair with the teeth in centric occlusion. Occlusal assessment was performed only on children who had complete primary dentition without any erupted permanent teeth and free from extensive caries that would affect the mesiodistal or occlusogingival dimension of a tooth and therefore influence the occlusal characteristics. One examiner with the aid of a mouth mirror and a millimeter gauge performed the examination throughout the study. The intra-examiner reliability was established by re-examination of 20 DS children in 2 different visits with one week apart (Kappa=0.88).

The following occlusal characteristics were recorded using the criteria of Foster and Hamilton⁸:

1. Second Primary Molar Relationship:

Flush Terminal Plane: (The distal surfaces of the upper and lower second primary molars in the same vertical plane). *Distal Step:* (The distal surfaces of the lower primary second molars in the posterior relationship to the distal surface of the upper second molars). *Mesial Step:* (The distal surfaces of the lower primary second molars in the anterior relationship to the distal surface of the upper second molars).

In determining the second primary molar relationship, if one side had a distal step or mesial step and the other side had a flush terminal plane, it was recorded as a flush terminal plane. If one side had a mesial step and the other had a distal step, it was excluded from the study.

2. Primary Canine Relationship:

Class I: (The tip of the maxillary primary canine tooth is in the same vertical plane as the distal surface of the mandibular primary canine). *Class II:* (The tip of the maxillary primary canine tooth is mesial to the distal surface of the mandibular primary canine). *Class III:* (The tip of the maxillary primary canine is distal to the distal surface of the mandibular primary canine).

In determining the primary canine relationship, if one side had class II or class III and the other side had class I, it was recorded as class I. If one side had class II and the other had class III, it was excluded from the study.

3. Degree of Overbite:

Overbite was graded according to the percentage of coverage of the mandibular primary incisors by maxillary primary incisors and recorded as normal if coverage was up to 50%; increased: if coverage was more than 50%; edge-to-edge: if the incisal edge of the maxillary primary incisors touched the

incisal edge of the mandibular primary incisors; and anterior open bite if there was no vertical overlap between the upper and lower primary incisors.

4. Degree of Overjet:

Overjet was measured as the greatest distance between the incisal edges of the maxillary and mandibular primary incisors in the occlusal plane and recorded as normal if a positive overjet was less than or equal to 2 mm; increased, if it was greater than 2 mm; and reversed, if there was anterior crossbite and edge-to-edge relationship was also assessed.

5. Posterior Crossbite: It was recorded when one or more of the maxillary primary canines or molars occluded lingual to the buccal cusps of the opposing mandibular teeth.

6. Scissors Bite: It was recorded when one or more maxillary primary molars occluded buccal to the buccal surfaces of the corresponding mandibular teeth.

The collected data were recorded on a special form and the Statistical Package for Social Science (IBM, SPSS version 20, Chicago, IL, USA) was utilized for statistical computation. Data analysis included descriptive statistics, chi-square test to identify differences for different variables, with the level of significance being set at $P < 0.05$.

RESULTS

The age of the participated children ranged between 3 and 6 years with a mean (\pm SD) age of 59 ± 3.8 months. Table 1 shows the distribution of the children examined in terms of age and gender. Of the 124 children examined, 60.5% presented with mesial step molar relationship, 34.7% with flush terminal plane and 4.8% with distal step, which was statistically significant ($P=0.001$); the prevalence in each age group is presented in Table 2. The mesial

step was the most common molar relationship in each age group. However, no statistically significant difference was observed in the prevalence of molar relationships in the four age groups ($P=0.421$). Regarding the canine relationship, class III represented 62.9% of the sample, followed by class I (32.3%) and class II (4.8%), which was statistically significant ($P=0.001$). The results showed no statistically significant difference in the prevalence of the canine relationship in the four age groups ($P=0.628$), as shown in Table 3.

Table 4 shows the distribution of overbite measurements among the sample by age. More than one-third of the sample (39.5%) had an edge-to-edge overbite followed by an anterior open bite in 28.2% of the sample, which was statistically significant ($P=0.027$). A significant increase in the prevalence of edge-to-edge and anterior open bite was observed in the age group 5 years and older, compared to age group 4 years and younger ($P=0.013$).

The majority of the children (48.4%) had an edge-to-edge overjet followed by reversed overjet (anterior crossbite) in 27.4%, which was statistically significant ($P=0.001$). An increase in the prevalence of edge-to-edge overbite was observed in the age group 5 years and older, compared to the age group 4 years and younger ($P=0.024$), as presented in Table 5.

One-third of the sample (33.8%) had a posterior crossbite. Unilateral posterior crossbite was the most common type, being present in 78.2% of the cases. Unilateral crossbite involving the whole posterior segment was observed in 48% of the cases with crossbite. There were no significant difference ($P=0.267$) in the prevalence of posterior crossbite in the different age groups. The presence of the scissors bite was assessed in the sample. However, no case was recorded in any age group.

TABLE (1) Distribution of the participants by age and gender.

| Age (years) | Boys N (%) | Girls N (%) | Total N (%) |
|--------------------|------------------|------------------|------------------|
| 3 | 9 (7.3) | 10 (8.1) | 19 (15.3) |
| 4 | 18 (14.5) | 20 (16.1) | 38 (30.6) |
| 5 | 22 (17.7) | 21 (16.9) | 43 (34.7) |
| 6 | 11 (8.9) | 13 (10.5) | 24 (19.4) |
| Total N (%) | 60 (48.4) | 64 (51.6) | 124 (100) |

TABLE (2) Prevalence of primary second molar relationship by age.

| Age (years) | Primary Second Molar Relationship | | | p-value |
|-----------------------|-----------------------------------|-------------------|-------------------|---------------|
| | Flush Terminal Plane N (%) | Distal Step N (%) | Mesial Step N (%) | |
| 3 | 7 (36.8) | 1 (5.3) | 11 (57.9) | 0.421 |
| 4 | 13 (34.2) | 2 (5.3) | 23 (60.5) | |
| 5 | 15 (34.8) | 2 (4.7) | 26 (60.5) | |
| 6 | 8 (33.3) | 1 (4.2) | 15 (62.5) | |
| Total (N= 124) | 43 (34.7) | 6 (4.8) | 75 (60.5) | 0.001* |

*indicates statistically significant values ($p < 0.05$)

TABLE (3) Prevalence of primary canine relationship by age.

| Age (years) | Primary Canine Relationship | | | p-value |
|-----------------------|-----------------------------|----------------|------------------|---------------|
| | Class I N (%) | Class II N (%) | Class III N (%) | |
| 3 | 7 (36.9) | 1 (5.2) | 11 (57.9) | 0.628 |
| 4 | 12 (31.6) | 2 (5.3) | 24 (63.1) | |
| 5 | 14 (32.6) | 2 (4.6) | 27 (62.8) | |
| 6 | 7 (29.2) | 1 (4.2) | 16 (66.6) | |
| Total (N= 124) | 40 (32.3) | 6 (4.8) | 78 (62.9) | 0.001* |

*indicates statistically significant values ($p < 0.05$)

TABLE (4) Prevalence of the degree of overbite by age.

| Age (years) | Overbite | | | | p-value |
|----------------------|-----------------|--------------------|-----------------------|-----------------------------|---------|
| | Normal N (%) | Increased N (%) | Edge-to-edge N (%) | Anterior open bite N (%) | |
| 3 | 6 (31.6) | 4 (21.1) | 5 (26.3) | 4 (21.0) | 0.013* |
| 4 | 10 (26.3) | 8 (21.0) | 11(29.0) | 9 (23.7) | |
| 5 | 4 (9.3) | 4 (9.3) | 21 (48.9) | 14 (32.5) | |
| 6 | 2 (8.3) | 2 (8.3) | 12 (50.0) | 8 (33.4) | |
| Total (N=124) | 22 (17.8) | 18 (14.5) | 49 (39.5) | 35 (28.2) | 0.027* |

*indicates statistically significant values ($p < 0.05$)

TABLE (5) Prevalence of the degree of overjet by age.

| Age (years) | Overjet | | | | p-value |
|-----------------------|-----------------|--------------------|-----------------------|-------------------|---------|
| | Normal N (%) | Increased N (%) | Edge-to-edge N (%) | Reversed N (%) | |
| 3 | 4 (21.1) | 3 (15.7) | 7 (36.8) | 5 (26.4) | 0.024* |
| 4 | 8 (21.0) | 5 (13.2) | 15 (39.5) | 10 (26.3) | |
| 5 | 4 (9.3) | 3 (7.0) | 24 (55.8) | 12 (27.9) | |
| 6 | 2 (8.2) | 1 (4.1) | 14 (58.3) | 7 (29.4) | |
| Total (N =124) | 18 (14.5) | 12 (9.7) | 60 (48.4) | 34 (27.4) | 0.001* |

*indicates statistically significant values ($p < 0.05$)

DISCUSSION

The present study provides an insight into patterns of the occlusal relationship in DS Saudi preschool children. Various epidemiological data have been reported about the occlusion properties in primary dentition among preschool children. However, there were insufficient reports in the literature regarding the assessment of occlusion in primary dentition of DS children. Several epidemiological studies on Saudi preschool children without DS were conducted by various investigators, such as Al-Sehaibany et al¹⁵, and Farsi and Salama.¹⁶

In this study, the prevalence of the mesial step molar relationship was observed to be the highest

in the children examined, which is greater than the reported data for non- DS Saudi preschool children.^{15,16} The increase in prevalence of the mesial step molar relationship coincides with the findings of other studies, such as the data of Vigild¹⁰, and Winter et al.¹³ These changes may be attributed to anteroposterior deficiency of the maxillary arch as reported by Vigild.¹⁰ Bishara et al¹⁷ evaluated the changes that occur during the shift from the primary second molar relationship to the permanent first molar relationship. Since the mesial step molar relationship in primary dentition may cause undesirable molar relationships and lead to the class III molar relationship in permanent dentition, these

cases therefore should be closely observed and continuously monitored in order to engage them in early orthodontic treatment if necessary and such intervention should be initiated at an early stage, because self-correction would not be possible. Moreover, they stated that the occurrence of the class III molar relationship in the permanent dentition would be the result of the degree of the mesial step in the second molars.¹⁷ Ngan and Fields¹⁸ reported the desired molar relationship in the primary dentition should be in the form of flush terminal plane. However, in the present study, the most common occlusal relationship in the primary canines was found to be class III with the prevalence of 61.4%. These results are higher than those reported by other studies for non- DS children,^{9,11,12} which may be attributed to anteroposterior maxillary deficiency, musculoskeletal abnormalities and altered cranial-base relationships, as reported by Winter et al.¹³

In regards to the vertical dimension of the primary dentition occlusion, as presented in the degree of the overbite, two-thirds of the children had either edge-to-edge or an anterior open bite, which was higher than several other studies of non-DS children.^{11,12,15,16} Such abnormalities in the degree of the overbite might be attributed to an increase in the rate of differential downward growth of the mandible, anteroposterior deficiency of the maxilla and might be a consequence of the abnormal tongue position in DS children compared to non-DS children. The findings of the present study showed that the most prevalent overjet was an edge-to-edge, which was observed in half of the participants, representing the most common among all age groups; these findings coincide with the study by Gullikson for DS children.³

The prevalence of the posterior crossbite in the present study was observed in one-third of the sample (33.8%), which is higher than the findings reported by Farsi and Salama,¹⁶ which was conducted on non-DS Saudi preschool children. The

different prevalence of the posterior crossbite might, to a certain extent, be due to the differences in the growth of the maxillary arch in the anteroposterior and transverse dimensions of DS children, compared to non-DS children.

As some features of occlusion in the primary dentition have been reported to be transferred from the primary to the permanent dentition, it would be interesting to observe through a longitudinal study for DS children the ultimate outcome of the different variations from primary dentition occlusion after the transition to the permanent dentition.

CONCLUSION

The present study suggests that Saudi preschool children with DS have a high tendency for abnormal occlusion during the primary dentition period. This observation warrants further study of a larger sample, including children from other provinces of Saudi Arabia.

ACKNOWLEDGMENTS

The author thanks Mr. Nassr Almaflahi for his assistance in the statistical analysis. The author also extends his appreciation to the College of Dentistry Research Center and Deanship of Scientific Research at King Saud University, Saudi Arabia for supporting this study.

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