



ORIGINAL ARTICLE

# A comparative study of oral health amongst trisomy 21 children living in Riyadh, Saudi Arabia: Part 1 caries, malocclusion, trauma



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## KEYWORDS

Down Syndrome;  
Caries;  
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**Abstract** *Background:* Trisomy 21 (T21) is a genetic disorder stemming from a chromosomal abnormality and characterized by general and mental retardation. Depending on the population, T21 is known to affect 1 in every 600–2000 live births. The current literature provides a mixed view on the oral health status of T21 individuals.

*Aim:* To establish the prevalence of dental caries, malocclusion, and trauma amongst children with T21 compared with non-T21 children in Riyadh, Saudi Arabia.

*Methods:* This cross-sectional study recruited non-T21 and T21 children between the ages of 7–15 years who were studying at the Saut Society. After informed consent was obtained from parents and both groups were matched by age and gender, trained examiners screened children at the dental clinic of King Saud University to record the presence of dental caries, malocclusion, and trauma in both groups.

*Results:* While there was no statistical difference between the two groups with regard to the mean decayed, missing, and filled teeth (DMFT) index (2.66 for T21 versus 3.11 for controls), T21 children had a higher prevalence of incisal fractures compared to the control group (24.73% versus 4.95%, respectively) and that was statistically significant ( $P < 0.05$ ). There were also highly significant group differences concerning the prevalence of malocclusion. Therein, 45% of T21 children had a Class III incisor relationship compared with 8% of control children, and 50% of T21 children had a Class III molar relationship compared with 8% of control children.

*Conclusions:* While there was no significant difference in the incidence of caries between children with and without T21, practitioners should be aware of the disparities in malocclusion and trauma in this vulnerable population.

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## 1. Introduction

Trisomy 21 (T21), also known as Down syndrome, is a genetic disorder stemming from a chromosomal abnormality that is characterized by a deficiency in general and mental development. Depending on the population, T21 is known to affect

1 in every 600 to 2,000 live births (Gorlin et al., 2001). Individuals with T21 present with characteristic physical and systemic manifestations, and typical craniofacial and orofacial features (Desai, 1997). The most common oral findings in these children include mouth breathing, open bite, macroglossia, fissured lips and tongue, delayed teeth eruption, missing and malformed teeth, microdontia, crowding, malocclusion, and bruxism (Desai, 1997; Hennequin et al., 2000; Asokan et al., 2008).

Previous research conducted in institutionalized T21 individuals has highlighted an extremely low prevalence of dental caries, perhaps due to the controlled diets administered in such institutions (Orner, 1975). Today, however, most T21 individuals live with their family, where there is greater exposure to a cariogenic diet. Current literature provides a mixed view on T21 individuals and the incidence of caries. Some studies have reported lower rates of caries in T21 individuals when compared to those without T21 (Shore et al., 2010; Shyama et al., 2001; Oredugba, 2007), while others have reported a higher caries rate in those with T21 (Guaré Rde et al., 2008; Fung and Allison, 2005). Furthermore, other studies have reported that people with and without T21 share the same caries rates (Areias et al., 2011). Several authors have also theorized that the reduced prevalence of caries in individuals with T21 may be due to delayed eruption of the teeth, increased spacing between teeth, or possible differences in the chemical content of the saliva (Morinushi et al., 1995).

It is well known that the self-care skills of children with T21 who suffer from intellectual and neuro-developmental disabilities are compromised because of delayed motor and cognitive abilities and result in an increased reliance on others for health and oral health care activities (McIver, 2001). There is also the perception that children with T21 may be at a decreased risk of dental caries, possibly because of factors related to salivary function (Cogulu et al., 2006). We are therefore presented with a mixed picture concerning the oral health of T21 children. Hence, the main objective of this study was to investigate the prevalence of dental caries, malocclusion, and trauma amongst children with T21 living in Riyadh, Saudi Arabia, in comparison to a control group of non-T21 children.

## 2. Subjects and methods

In Riyadh, the capital of Saudi Arabia, there are three special schools for children with T21. Of these, the Saut Society (the voice of the Down Syndrome Society) provides education for 60% of Riyadh children with T21 aged 3–16 years. For this study, children with T21 between 7–15 years who were attending the Saut Society formed the study group, while an age- and gender-matched control group of children without T21 was selected from a sample of schools in Riyadh and from all socioeconomic classes. Following participant screening and selection, parents were informed about the study and consent forms were signed. The study was approved by the Research Center Ethics Committee of King Saud University, College of Dentistry.

Social classes in Western countries are often based upon the level of education of the head of household; however, in countries that are in transition (such as Saudi Arabia), social class is not as easy to define because of dramatic changes in culture and infrastructure. An alternative way of classifying social

class is based on the level of income in the Saudi population. In this study, social class was estimated by both the father's occupation and the mother's education, following the methods of the Oral Health Survey of Saudi Arabia in 1991 (Al-Shammmary et al., 1991). Therein, the social class according to the father's occupation can be divided into three groups: upper-class professionals (doctors, professors, architects) and businessmen; middle-class governmental officials (military and governmental workers); and lower-class manual workers (farmers), unskilled workers, and others (including students, the unemployed, and those not indicating any occupation). The social class according to the mother's education can similarly be divided into three groups: upper class, with a degree level of education (University and/or postgraduate); middle class, with a secondary level of education; and lower class, with only a primary level of education.

Children were transported to the dental clinic of King Saud University, where an oral examination was conducted by two examiners who were trained according to the WHO criteria for diagnosing dental caries malocclusion and trauma. The decayed, missing, and filled teeth (DMFT) index was used to assess caries prevalence. Malocclusion was evaluated using Angle's classification according to the WHO Oral Health Survey Basic Methods (WHO, 1997). Additionally, the examiner also recorded trauma to incisors by assessing the type of damage sustained and any treatment that had been previously carried out. Oral examination was standardized and the oral status of individuals was documented. A pair of sterile gloves and a set of sterilized instruments were used for each subject. A blunt probe was used to remove any gross debris from the surface of the teeth; however, there was no further cleaning or drying of teeth prior to examination. Each tooth was examined and charted for both dental caries and malocclusion.

Following data collection, the SPSS program (version 22) was used for analysis. Both descriptive and analytic approaches were used in the data analyses. Findings were compared across group (study and control), age (7–15 years), and gender using descriptive statistics, the chi-square test, and the Kruskal–Wallis test for the two groups where appropriate. Values are most commonly reported as mean  $\pm$  standard deviation. The level of significance was set at  $P < 0.05$ . There was no inter-examiner difference between the two examiners.

## 3. Results

### 3.1. Preliminary analyses

Our cohort consisted of 93 T21 children (34 female and 59 male) and 99 non-T21 children (47 female and 52 male), with a mean age of 10.75 years. 90% of the children included in the study came from middle-class families. Preliminary analyses highlighted that participants with T21 were only slightly younger ( $10.61 \pm 2.47$  years) than the control group ( $10.89 \pm 2.29$ ). Additionally, there was no significant difference in the distribution of genders across both groups ( $P = \text{NS}$ ).

### 3.2. Decayed, missing, and filled teeth

As displayed in Table 1, while the control group had a slightly higher number of decayed teeth ( $2.37 \pm 2.20$ ) when compared with the T21 group ( $2.11 \pm 3.13$ ), this difference was not significant ( $P = 0.495$ ). There were also no significant differences between groups in relation

**Table 1** Prevalence of dental caries via DMFT score amongst children with and without T21.

DMFT indices	T21 group (n = 93)		Control group (n = 99)	
	M	SD	M	SD
Decayed teeth	2.11	3.13	2.37	2.20
Filled teeth	0.52	1.26	0.55	1.16
Missing teeth	0.29	0.89	0.19	0.80
Total DMFT score	2.66	3.09	3.11	2.58

**Table 2** Comparison of malocclusion amongst children with and without T21.

	Malocclusion	T21 group (n = 93)		Control group (n = 99)	
		M	SD	M	SD
Incisal relation	Class I	23	24.7	77	78.8
	Class II	25	26.9	13	13.1
	Class III	45	48.4	8	8.1
Molar relation	Class I	23	24.7	78	78.8
	Class II	20	21.5	13	13.1
	Class III	50	53.8	8	8.1

**Table 3** Proportion of children with trauma experience.

Trauma	Children with trauma experience	
	T21 group (93)	Control group (99)
Mean Trauma ( $\pm$ ) SD	0.24 (0.36)	0.05
No (%) of children with trauma	23 (24.7)	5 (4.95)

to the number of filled teeth ( $P = 0.867$ ), or the number of missing teeth ( $P = 0.422$ ). Finally, there was also no significant difference between the T21 and control groups with respect to the total DMFT score ( $2.66 \pm 3.09$  and  $3.11 \pm 2.58$ , respectively;  $P = 0.268$ ).

The differences between genders, age, and social class in relation to DMFT failed to reach statistically significant levels when tested using the Chi-square test in the two groups.

### 3.3. Incisal and molar relationships

Molar relation was recorded according to Angle's classification. The molar relationship of the two groups is summarized in Table 2. There were highly significant group differences concerning the prevalence of malocclusion, as more T21 children had Class III incisor relationship compared to control (45% versus 8%, respectively;  $P \leq 0.05$ ) and Class III molar relationship compared to control (50% versus 8%, respectively;  $P < 0.001$ ).

### 3.4. Trauma

The types of trauma damage that were recorded ranged from "discoloration" to "fracture of enamel" to the "loss of one or more teeth." As shown in Table 3, the proportion of children with damage to their incisors was 24.73% in T21 versus 4.95% in the control group. The proportion of children with different types of trauma for all incisors

showed that the most common types of fractures in T21 children were enamel and dentine fractures (6%), followed by enamel fractures (2.9%). The proportion of children with trauma was related to gender. In both groups, males tended to have higher levels of trauma than females. While this difference was not statistically significant in the control group, it was significant in the T21 group (16.3% in males versus 6.7% in females,  $P = 0.004$ ).

## 4. Discussion

This study measured the prevalence of dental caries, malocclusion, and trauma among children with T21 compared to children without T21 in Riyadh, Saudi Arabia. The findings found no statistically significant differences between the T21 group and the control group when dental caries was assessed using the DMFT index. However, the groups differed significantly with respect to incisal and molar relationships. Children in the T21 group were more likely to have a Class III incisal and molar relationship when compared to children in the control group. In addition, T21 children had a higher prevalence of incisal fractures when compared to the control group.

Although the study sample was from only one institute in Riyadh, children who attend this institute represent 60% of all schoolchildren in Riyadh and are representative of the wider T21 population residing in Saudi Arabia. Additionally, the sample used in this study included a good distribution of age and gender parameters.

While this study reported similar DMFT scores for both the T21 group and the control group, other studies of T21 children have found mixed results. A large proportion of published studies have reported that patients with T21 have lower rates of dental caries when compared to those without T21 (Shore et al., 2010; Shyama et al., 2001; Oredugba, 2007; Macho et al., 2013), potentially due to the delayed eruption of teeth (Morinushi et al., 1995). Specifically in the Macho et al. (2013) study found a lower caries prevalence amongst a T21 population when compared to a control group, and also noted that more T21 children belonged to a higher socioeconomic background. In general, a child growing up in a low socioeconomic environment has certain social, economic, and educational disadvantages, which may limit access to professional health care services. However, the present study population was largely from a middle socio-economic condition and found no significant difference in caries prevalence between children with and without T21.

Oredugba (2007) reported that children aged < 10 years with T21 had oral hygiene similar to their counterparts without T21; however, the author also noted that, amongst individuals with T21, oral hygiene decreased as age increased, which may have an effect on our study given that our population had a mean age of 10.75 years. Furthermore, Maria-Areias et al. stated that T21 children had significantly less decay compared to children without T21 (78% versus 58%, respectively) (Areias et al., 2011), while another study reported a non-statistically significant trend for a higher mean DMFT index amongst T21 children compared with non-T21 children ( $0.23 \pm 0.64$  versus  $0.09 \pm 0.29$ , respectively;  $P > 0.05$ ) (Oredugba, 2007). Our study also did not show any significant difference between the two groups, but highlighted that most of the caries in the T21 group was untreated.

While this study reported that children with T21 are more likely to have a Class III malocclusion, Vigild et al. found that 41% of individuals with T21 had a mandibular overjet (Vigild, 1985). Other studies also support these findings, and suggest that the primary reason for the high prevalence of malocclusions (stemming from vertical and transversal occlusal alterations) in children and adolescents with T21 is genetic and manifest as anterior open bite, anteroposterior crossbite, and proclination of the anterior teeth. Some other contributing factors could be nail or finger biting, mouth posture, and upper airway infections (Bhowate and Dubey, 2005; Oliveira et al., 2008).

T21 children in general are known to have delayed motor and cognitive abilities, which lead to a higher risk of trauma and injury of the oral cavity from falls or accidents (Oredugba, 2007). Our study highlighted the fact that a significant percentage of children with T21 have a history of trauma and incisal injury. Hence, we suggest that institutions serving this vulnerable group should have tooth-saving kits and emphasize the need to educate caregivers on the importance of immediate professional attention in the case of dental trauma.

## 5. Conclusions

It is important for healthcare planners to identify and quantify the needs of their target population. This study throws light on the oral health needs of children with T21 compared with non-T21 children. This is helpful in establishing priorities concerning preventive and therapeutic activities. It also adds to the current literature and makes it possible to improve the dental situation for this vulnerable group, thereby helping them achieve better oral function and an improved quality of life.

## Conflict of interest

The author declares no conflict of interest.

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