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ORIGINAL ARTICLE

Comparative study of oral health among trisomy 21 children living in Riyadh, Saudi Arabia: Part 2, gingival condition

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KEYWORDS

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Abstract *Background:* Trisomy 21 (T21) is a congenital disorder characterized by triplication of Chromosome 21 components. Patients with T21 have an increased risk of acquiring periodontal disease due to their inability to maintain good oral hygiene. Consequently, it is important to determine an approach for disease prevention in this population.

Aim: The purpose of the study was to assess the periodontal health, through the prevalence of gingivitis and plaque, among children with T21 living in Riyadh, Saudi Arabia.

Subjects and method: This study included 93 children with T21 and 99 age- and gender-matched children without T21 between the ages of 7 and 15 years. Parents were informed about the study and provided informed consent. Trained examiners using standardized tools assessed the prevalence rates of gingivitis and plaque in all children.

Results: Gingivitis prevalence was elevated among T21 children (46.9%) compared to controls (34%) in all arch sextants except the mandibular middle ($P < 0.01$). Comparing the two groups, the prevalence of plaque was higher in the maxillary right sextant of the T21 group and the mandibular middle sextant of the control group ($P < 0.05$).

Conclusion: T21 children have significantly elevated plaque levels, resulting in greater prevalence of gingivitis, compared to healthy children. Preventive measure, such as oral health awareness programs, should be delivered early to parents and continued at school to encourage and motivate children.

1. Introduction

Trisomy 21 (T21, also known as Down Syndrome) is a major congenital disorder that is characterized by triplication of Chromosome 21. Phenotypic expression of this triplication is observed in 95% of T21 individuals, with the remaining 5% showing close associations with other chromosomal abnormalities. Common Chromosome 21-related anomalies include

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partial trisomy, mosaicism, and translocation (Desai, 1997; Galley, 2005).

Individuals with T21 are at risk of developing serious physical and systemic manifestations, including gastrointestinal, cardiac, craniofacial, dermatological, and orofacial anomalies (Desai, 1997). Oral findings include mouth breathing, delayed tooth eruption, malformed teeth, bruxism, crowding, fissured tongue and lips, missing teeth, malocclusion, and macroglossia (Asokan et al., 2008; Desai, 1997; Hennequin et al., 2000). The self-care, including oral self-care, capabilities of T21 children are often compromised due to neurodevelopmental and intellectual complications, impaired cognitive abilities, and delayed motor responses (McIver, 2001).

Periodontal diseases are destructive inflammatory diseases that affect tooth structures, including the periodontal ligament, gingiva, alveolar bone, and cementum. Many factors are closely related to the development of periodontal disease, such as poor nutrition or oral hygiene, genetic/immunological factors, and local irritants. T21 individuals have an extremely high prevalence rate and rapid onset of periodontal diseases (Reuland-Bosma and van Dijk, 1986), with periodontal disease being observed among 96% of T21 adults (Oredugba, 2007). Therefore, we aimed to assess the periodontal health, through the prevalence rates of plaque and gingivitis, of children with and without T21 within the territories of Riyadh, Saudi Arabia.

2. Subjects and methods

Saut Society (associated with the Down Syndrome Society) is one of three schools in Riyadh, Saudi Arabia, that provides education specifically to T21 children. Each year, Saut Society enrolls 60% of school-attending T21 children aged 3–16 years in Riyadh. The study group in this study consisted of T21 children between 7 and 15 years of age who were attending Saut Society. The control group comprised children without T21, who were selected from among schools in Riyadh and represented every socioeconomic class. After sample selection, parents were informed about the study, and informed consent was obtained. The Research Centre Ethical Committee of King Saud University, College of Dentistry approved this research study and its protocols.

Study participants were transported to the dental clinic of King Saud University, where they underwent standardized oral examination by trained examiners, who used new sterile gloves and sterilized instruments for each subject. Both gingival indices and plaque indices were used, however this was modified to suit children with T21, as they are less likely to co-operate. To assess the periodontal status, each arch was divided into 3 quadrants (right, left and anterior) and instead of reporting the severity of the plaque deposition and gingivitis, our study reported the prevalence by indicating whether or not they were present in each of the 6 quadrants. Before examination, advanced approaches were used to remove any gross debris from the tooth surface, without any further cleaning or drying of the teeth. Each tooth surface was examined and charted for gingivitis and plaque indices, in accordance with the criteria of World Health Organization with modifications to suit children with T21 (Rebelo & Queiroz, 2007). The prevalence, rather than the severity, of plaque or gingivitis was recorded at each of six sextants in the dental arches (mandibular and maxillary right, left, and anterior).

The SPSS program (Version 22) was used for data analysis, which incorporated descriptive and analytic approaches. The chi-square and Kruskal–Wallis tests were used in the process of data analysis. The level of significance was $P < 0.05$.

3. Results

3.1. Preliminary analyses

The study group comprised 93 children with T21 (34 girls, 59 boys). The control group comprised 99 children without T21 (47 girls, 52 boys). The mean age of the whole sample was 10.75 years. Most children were from middle-class families. Participants with T21 were slightly younger ($M = 10.61$, $SD = 2.47$) than controls ($M = 10.89$, $SD = 2.29$). The groups did not significantly differ with regard to the distribution of age [t (190) = 0.83, $P = .406$, $d = 0.12$; independent samples t-test] or sex [χ^2 (1) = 2.34, $P = .126$, $d = 0.11$].

3.2. Gingivitis

As reported in Table 1, T21 children had significantly more gingivitis (46.9%) than controls (34%) in all sextants of the mouth except the maxillary and mandibular middle sextants. Compared to controls, T21 participants were more likely to present with gingivitis in the maxillary right [$\chi^2$22 (1) = 18.03, $P < .001$, $d = 0.31$], maxillary left [$\chi^2$22 (1) = 11.08, $P = .001$, $d = 0.24$], mandibular right [$\chi^2$22 (1) = 14.02, $P < .001$, $d = 0.27$], and mandibular left sextants [$\chi^2$22 (1) = 14.02, $P < .001$, $d = 0.27$]. Compared to T21 participants, control participants were more likely to have gingivitis in the mandibular middle sextant [$\chi^2$22 (1) = 10.86, $P = .001$, $d = 0.24$]. Gingivitis prevalence did not differ between the groups in the maxillary middle sextant [$\chi^2$22 (1) = 0.02, $P = .892$, $d = 0.01$].

3.3. Plaque

As shown in Table 2, there was no overall difference between the groups in the prevalence of plaque (72% in the T21 group, 69% in the control group). The T21 group had more plaque in the maxillary right sextant compared to the control group [$\chi^2$22 (1) = 6.88, $P = .009$, $d = 0.19$]. However, there were no significant between-group differences in plaque in the maxillary middle [$\chi^2$22 (1) = 0.94, $P = .333$, $d = 0.07$], maxillary left [$\chi^2$22 (1) = 3.08, $P = .079$, $d = 0.13$], mandibular right [$\chi^2$22(1) = 2.67, $P = .102$, $d = 0.12$], or mandibular left sextant [$\chi^2$22 (1) = 2.80, $P = .094$, $d = 0.12$]. The control group was more likely to have plaque in the mandibular middle sextant than the study group [$\chi^2$22 (1) = 6.95, $P = .008$, $d = 0.19$].

4. Discussion

This study reports the prevalence rates of gingivitis and plaque among T21 children compared to children without T21 in

Table 1 Prevalence of gingivitis among children with and without T21.

Gingivitis	T21 group (n = 93)		Control group (n = 99)	
	Present (n)	%	Present (n)	%
Upper right	47	50.5	21	21.2
Upper middle	47	50.5	51	51.5
Upper left	45	48.4	25	25.3
Lower right	40	43.0	18	18.2
Lower middle	43	46.2	69	70.0
Lower left	40	43.0	18	18.2

Table 2 Prevalence of plaque among children with and without T21.

Plaque	T21 group (n = 93)		Control group (n = 99)	
	Present (n)	%	Present (n)	%
Upper right	81	87.1	71	71.7
Upper middle	75	80.6	85	85.9
Upper left	79	84.9	74	74.7
Lower right	76	81.7	76	76.8
Lower middle	69	74.2	88	88.9
Lower left	77	88.8	72	72.7

Riyadh, Saudi Arabia. The findings highlight an increased prevalence of gingivitis among T21 children in all sextants except the mandibular middle, where gingivitis was more frequent in the control group. Plaque was more prevalent in the maxillary right sextant of the T21 group and in the mandibular middle sextant of the control group. No other significant between-group differences in plaque were found.

The sample used in this study presented good distributions with respect to age and sex, although the study sample was from one institute in Riyadh. Children who attend the selected institute represent 60% of all school-going T21 children in Riyadh. Therefore, this sample should be representative of and generalizable to the wider T21 population in Saudi Arabia. Differences between groups may be associated with the oral predisposition of T21 individuals to have certain facial and dental features (Asokan et al., 2008; Desai, 1997; Hennequin et al., 2000). In addition, neurodevelopmental disabilities among T21 individuals can lead to delayed motor and cognitive abilities and reduced manual dexterity (Cornejo et al., 1996; McIver, 2001).

Relatively large and poor tone of the masticatory muscles/-tongue and mouth breathing are contributing factors to an increased risk of chronic periodontitis. These factors also can result in increased tooth mobility and eventual tooth loss (Hennequin et al., 1999; Desai, 1997; Pilcher, 1998). Moreover, the reduced salivary flow rate among T21 individuals increases the risk of acquiring periodontal disease through dry mouth (Chaushu et al., 2002; Siqueira et al., 2005).

Despite the anatomic differences, studies have highlighted a subgroup of T21 individuals who exhibit altered physiology, particularly with regard to periodontal disease. There are numerous physiologic alterations that include a shortened neutrophil half-life and decreased phagocytic ability. The diminished chemotaxis of neutrophils has been identified as the primary reason for poor immune response. Neutrophils are the first line of defense against infection; therefore, their deficiency would create an ideal environment for the onset of periodontal destruction (Barkin et al., 1980; Izumi et al., 1989; Yavuzyilmaz et al., 1993). Certain bacteria, inappropriate oral hygiene, and viral co-infections also increase the severity of periodontal disease (Loesche and Grossman, 2001).

T21 children are at a disadvantage genetically, and follow-up of their dental care is an emerging challenge. Studies comparing professional dental care and oral hygiene habits between T21 children and their siblings have reported that T21 individuals have difficulty in accessing dental services (Allison et al., 2000). Lowered efficacy of self-care, limited manual dexterity, and limited access to care are all factors related to the increased levels of plaque and gingivitis among these children (Lopez-Pérez et al., 2002). Therefore, pertinent measures are needed to address the high prevalence of gingivitis not related to periodontal disease among T21 individuals. Such measures may include eliminating dental biofilm, which directly contributes to the development and severity of gingivitis, by mechanical and chemical control, as well as improving oral health awareness among parents and caregivers of T21 children. Although parents of T21 children often receive oral healthcare information in their child's early years, research has shown that this approach is often substandard and minimal (Kaye et al., 2005). Oral healthcare information should be delivered sensitively before and during the eruption phase to motivate, educate, and aid parents in caring for these children. Furthermore, because oral health is often of low priority for T21 children, parents and caregivers should be encouraged to visit a dentist more frequently and as soon as deciduous teeth erupt.

Given the generally low manual dexterity and motivation of T21 children, rigorous oral health awareness programs are needed within schools as well as mother and toddler groups. These programs should focus on dexterity aids such as Gripmate®, which improves plaque elimination by enabling better control of manual toothbrushes. Powered toothbrushes with an oscillating or rotating action could also be used to prevent periodontal disease (Robinson et al., 2005). In addition to mechanical methods of plaque elimination, there is strong evidence for chemical and/or antimicrobial agents, such as chlorhexidine mouthwash, combined with tooth brushing.

5. Conclusion

A complex multifactorial interaction between the environment and the host response influences individual susceptibility to periodontal disease. Although T21 individuals are genetically predisposed to periodontal disease, increased plaque levels can be controlled via a regular oral hygiene regime. The findings of the study demonstrate that the prevalence of periodontal disease is extremely high among T21 children. Preventive measures, such as oral health awareness programs, should be delivered to parents and caregivers early in their child's life. These programs should be continued at school, to encourage and motivate children, reduce plaque formation, and decrease the prevalence of periodontal disease among children with T21.

Conflict of interest

The author declares no conflict of interest.

References

Allison, P.J., Hennequin, M., Faulks, D., 2000. Dental care access among individuals with down syndrome in France. Spec. Care Dentist. 20, 28–34 (retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1754-4505.2000.tb00007.x/abstract>).

Asokan, S., Muthu, M.S., Sivakumar, N., 2008. Dental caries prevalence and treatment needs of down syndrome children in Chennai, India. Indian J. Dent. Res. 19, 224–229 (retrieved from dental caries prevalence and treatment needs of down syndrome children in Chennai, India).

Barkin, R.M., Weston, W.L., Humbert, J.R., Sunada, K., 1980. Phagocytic function in down syndrome – II. Bactericidal activity

and phagocytosis. J. Ment. Defic. Res. 24 (Pt 4), 251–256 (retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2788.1980.tb00079.x/abstract>).

Chaushu, S., Becker, A., Chaushu, G., Shapira, J., 2002. Stimulated parotid salivary flow rate in patients with down syndrome. Spec. Care Dentist. 22, 41–44 (retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1754-4505.2002.tb01208.x/abstract>).

Cornejo, L.S., Zak, G.A., Dorronsoro de Cattoni, S.T., Calamari, S. E., Azcurra, A.I., Battellino, L.J., 1996. Bucodental health condition in patients with down syndrome of Cordoba City, Argentina. Acta Odontol. Latinoam. 9, 65–79 (retrieved from <http://europepmc.org/abstract/MED/11885251>).

Desai, S.S., 1997. Down syndrome: a review of the literature. Oral Surg. Oral Med. Oral Pathol. Oral Radiol. Endod. 84, 279–285 (retrieved from <http://www.sciencedirect.com/science/article/pii/S1079210497903437>).

Galley, R., 2005. Medical management of the adult patient with down syndrome. JAAPA 18, 45–46 (48, 51–52. retrieved from <http://journals.lww.com/jaapa/Abstract/2005/04000/Medical_management_of_the_adult_patient_with_Down.6.aspx>).

Hennequin, M., Allison, P.J., Veyrune, J.L., 2000. Prevalence of oral health problems in a group of individuals with down syndrome in France. Dev. Med. Child Neurol. 42, 691–698 (retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1469-8749.2000.tb00681.x/pdf>).

Hennequin, M., Faulks, D., Veyrune, J.L., Bourdiol, P., 1999. Significance of oral health in persons with down syndrome: a literature review. Dev. Med. Child Neurol. 41, 275–283 (retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1469-8749.1999.tb00599.x/pdf>).

Izumi, Y., Sugiyama, S., Shinozuka, O., Yamazaki, T., Ohyama, T., Ishikawa, I., 1989. Defective neutrophil chemotaxis in down's syndrome patients and its relationship to periodontal destruction. J. Periodontol. 60, 238–242 (retrieved from <http://www.joponline.org/doi/abs/10.1902/jop.1989.60.5.238>).

Kaye, P.L., Fiske, J., Bower, E.J., Newton, J.T., Fenlon, M., 2005. Views and experiences of parents and siblings of adults with down syndrome regarding oral healthcare: a qualitative and quantitative study. Br. Dent. J. 198, 571–578 (discussion 559, retrieved from <http://www.nature.com/bdj/journal/v198/n9/full/4812305a.html>).

Loesche, W.J., Grossman, N.S., 2001. Periodontal disease as a specific, albeit chronic, infection: diagnosis and treatment. Clin. Microbiol. Rev. 14, 727–752 (retrieved from <http://cmr.asm.org/content/14/4/727.full>).

Lopez-Pérez, R., Borges-Yáñez, S.A., Jiménez-García, G., Maupomé, G., 2002. Oral hygiene, gingivitis, and periodontitis in persons with down syndrome. Spec. Care Dentist. 22, 214–220 (retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1754-4505.2002.tb00274.x/abstract>).

McIver, F., 2001. Promoting oral health of children with neurodevelopmental disabilities and other special health care needs: A meeting to develop training and research agendas, center on human development and disability. In: Access to Care: A Clinical Perspective. University of Washington, Seattle, WA, pp. 167–171.

Oredugba, F.A., 2007. Oral health condition and treatment needs of a group of Nigerian individuals with down syndrome. Downs Syndr. Res. Pract. 12, 72–76 (retrieved from <http://www.down-syndrome.org/reports/2022/?page=1>).

Pilcher, E.S., 1998. Dental care for the patient with down syndrome. Downs Syndr. Res. Pract. 5, 111–116 (retrieved from dental care for the patient with down syndrome).

Reuland-Bosma, W., Van-Dijk, J., 1986. Periodontal disease in down's syndrome: a review. J. Clin. Periodontol. 13, 64–73 (retrieved from <http://onlinelibrary.wiley.com/doi/10.1111/j.1600-051X.1986.tb01416.x/full>).

Robinson, P.G., Deacon, S.A., Deery, C., Heanue, M., Walmsley, A. D., Worthington, H.V., Glenny, A.M., Shaw, W.C., 2005. Manual versus powered toothbrushing for oral health. Cochrane Database Syst. Rev., CD002281 (retrieved from <http://wwwupdate-software.com/pdf/CD002281.pdf>).

Siqueira, W.L., Bermejo, P.R., Mustacchi, Z., Nicolau, J., 2005. Buffer capacity, pH, and flow rate in saliva of children aged 2–60 months with down syndrome. Clin. Oral Invest. 9, 26–29 (retrieved from <http://link.springer.com/article/10.1007/s00784-004-0282-3>).

Yavuzyilmaz, E., Ersoy, F., Sanal, O., Tezcan, I., Erçal, D., 1993. Neutrophil chemotaxis and periodontal status in down's syndrome patients. J. Nihon Univ. Sch. Dent. 35, 91–95 (retrieved from <http://europepmc.org/abstract/MED/8410208>).

Rebelo, B.M.A., Queiroz, C.A., Gingival Indices: State of Art, 2007. Retrieved from <http://cdn.intechopen.com/pdfs-wm/20291.pdf>.