Salivary constituents of children with Down and Turner syndrome in relation to dental caries incidence

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Dedication

This work is dedicated to:

Loving memory to my dear father

To my dear mother, to my beloved husband for there continuous help and support. Finally to my beloved son Aly and beloved daughter Rana.

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Introduction

Down syndrome is one of the chromosomal disorder caused by an error in cell division that results in the presence of an additional third chromosome 21 or "trisomy 21" and it is the most frequent genetic cause of mild to moderate mental retardation and associated medical problems. It occurs in one out of 800 live births, in all races and economic groups.

An enlargement of the thyroid gland, and disturbances in the autonomic nervous system, occurs slightly more frequently in babies with Down syndrome. Several other well-known medical conditions, including hearing loss, congenital heart disease, and vision disorders, are more prevalent among those with Down syndrome.

Oral findings that may be associated with Down syndrome include mouthbreathing, openbite, appearance of macroglossia, fissured lips and tongue, angular chelitis, delayed eruption times, missing and malformed teeth, small roots, crowding and periodontal diseases. Dental caries susceptibility is usually reduced in those children with Down syndrome.

Turner syndrome (TS) is another chromosomal disorder and a common genetic disease, resulting from the partial or complete absence of one sex chromosome, and occurring in approximately 50 per 100,000 live born girls. Turner syndrome is associated with reduced adult height and with gonadal dysgenesis, leading to insufficient circulating levels of female sex steroids and to infertility. Morbidity and mortality are increased in Turner syndrome but average intellectual performance is within the normal range. The risks of type 2 diabetes, type 1 diabetes, hypothyroidism, osteoporosis, congenital heart disease, hypertension, ischemic heart disease, aortic dilatation,

inflammatory bowel disease and celiac disease are clearly elevated, and proper care during adulthood is important.

The most frequent oral findings are: high palatal vault and hypoplastic mandible. Gingival index and plaque index were significantly higher in patients with Turner's syndrome.

The prevalence of dental caries among children suffering from the Down and Turner syndrome has been reported to be lower than in normal children so consequently, it was of special interest to search for the possible reasons in salivary constituents of these children; because saliva has many properties that may serve to maintain oral health and create an appropriate ecologic balance.

Salivary properties have been reported to be affected by many factors: stimulation, age, nutrition, disease, drugs and hormones. Saliva possesses a large number of organic and inorganic components which have been identified as protecting the teeth against caries.

Saliva plays an important role in oral health; it maintains the integrity of the oral hard and soft tissues, protects the oral tissue against immunologic injury, bacterial, fungal and viral infections. A critical role in the prevention of dental caries has been documented, it controls the equilibrium between demineralization and remineralization in a cariogenic environment, salivary buffers can reverse the low PH in plaque, allows for oral clearance thus prevent the deminiralization of enamel. It has been suggested that in addition to these properties, the flow rate and viscosity of saliva may influence the development of caries; it was noticed that salivary flow rate less than 0.7 ml/minute increase the risk for tooth destruction.

Mutans streptococci are the main cariogenic microorganisms present in the oral cavity, especially Streptococcus mutans and Streptococcus sobrinus. These pathogens can colonize the tooth surface and produce acids at a faster speed than the capacity of neutralization of the biofilm in an environment below the critical pH value (less than 5.5), which results in the destruction of the tooth enamel.

Secretory immunoglobulin A (SIgA) constitutes the predominant immunoglobulin isotype in secretions, including saliva. It is considered to be the first line of defense of the host against pathogens which colonize or invade surfaces bathed by external secretions. The main function of SIgA antibodies seems to limit microbial adherence as well as penetration of foreign antigens into the mucosa. Since caries and periodontal diseases are associated with indigenous bacteria, salivary IgA induced against *Streptococcus mutans* leads to a reduction in the colonization of this bacterium, and consequently, to the prevention of dental caries.

Review of literature

Dental caries is one of the most infectious diseases seen in all populations. It can be defined as a disease of the calcified tissues of the teeth. It is characterized by a decalcification of the inorganic portion which accompanied or followed by a disintegration of the organic substance of the tooth **(Willsmore, 1937)**.

Dental caries is a complex disease, the etiology of which has received significant research attention during the nineteenth and most of the twentieth centuries. Different etiological factors were associated with dental caries. The dominant theory in the middle of the nineteenth century was the "worm theory." At the International Medical Congress held in London in 1881, Drs. Miles and Underwood proposed that dental caries development was dependent on the presence and proliferation of "organisms." They claimed that dental caries was caused by direct action of microorganisms that penetrated the dental tubules and destroyed the organic component of the dentin leaving the inorganic parts to be broken down and washed away in fluids of the mouth **(Willsmore, 1937 and MacPhee, 1938).**

Three general theories regarding the mechanism of dental caries have been postulated: The Acidogenic theory or Miller's chemoparasitic theory, the Proteolytic theory and the Proteolysis- Chelation theory.

The Acidogenic theory or Miller's chemoparasitic theory is the most accepted theory. This theory states that dental caries is a chemico-parasitic

process consisting of two stages, decalcification of enamel and dentin followed by dissolution of the softened residue. The acids which initiate the primary decalcification are derived from the action of microorganisms on sugars and starches lodged in the retentive sites of the teeth (**Miller, 1890**).

Miller's research led to a storm of debate and controversy. Following the dissemination of Miller's findings, dietary and nutritional factors received extensive study for most of the last 150 years. Again, much of what was reported was based on observations such as those related to the physical and chemical characteristics of diet or nutrients, changes in the environment surrounding teeth such as saliva and microorganisms, or changes in the structure of teeth. By the mid-1920s, it seems that the environmentalists won over those who argued that the structure of teeth play a major role in the caries process. The nutrition-caries hypothesis was partially discredited by the finding that populations who were malnourished had lower caries prevalence than those who were well nourished. Also discrediting that hypothesis were findings from the pivotal and undoubtedly one of the most unethical studies ever reported in the dental literature, the Vipeholm Dental Caries Study, which found that frequent consumption of sugar increases the risk of developing dental caries **(Gustafsson, 1954, Clarkson, 1999 and Ismail et al., 2001)**.

Dental caries development is considered to involve a triad of indispensable factors: bacteria in dental plaque (agent), carbohydrates in the diet (substrates), and susceptible teeth (the host) **(Houte, 1994)**.

The final result, "caries to be or not to be", is a complex phenomenon involving internal defense factors, such as saliva, tooth surface morphology, general health, and nutritional and hormonal status, and a number of external