



## A REVIEW ARTICLE

# INTEGRITY OF THE DENTITION AND ITS EFFECT ON SYSTEMIC HEALTH IN CHILDREN – A REVIEW

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## ABSTRACT

A healthy child becomes a healthy adult that depends on various factors and digestion to efficiently absorb nutrients playing a major role. The digestion of food is central to human nutrition, health and wellbeing. The function of the jaws and teeth primarily being to transform the food into a more digestible form by combining it with saliva that contains digestive enzymes which is very important in the digestive process and absorption of nutrients into the blood stream. Recognizing the importance of oral health is the key to the healthy development of children and detection of oral conditions must be made mandatory when encountering malnutrition.

**KEYWORDS:** Oral Disease, Nutrition, Malnutrition, Digestion, Oral Health, Early Childhood Caries.

## INTRODUCTION

Oral health is one of the key factors of human nutrition and are the determinants of general health of an individual and more in a child considering the increased demand of nutrients for the physical and mental development which has a direct dependency on the number of healthy teeth<sup>1,2</sup>. According to the World Health Organization, Nutrition is the science of food and its relationship to health and by definition Malnutrition is the cellular imbalance between the supply of the nutrients and the energy and the body's demand for them to ensure growth, maintenance, and specific functions<sup>3</sup>. The effect of diet and nutrition has been a well-reviewed topic in contrary the presence of debilitating effects of dental caries on masticatory effects leading to poor nutrition intake is to be more discussed considering the need to diagnose the cause of nutritional deficiency or malnutrition in Children. This review provides an overview of the digestive process associated with mastication and the effects disturbances of oral structures on the process of digestion and its systemic effects.

## DISCUSSION

### The Digestive process in the oral cavity

Considering the modern processed food preference Norton *et al* had stated that all the food must pass through the digestive tract, therefore there is a need to design the foods of the future based on the understanding of what happens in the digestive process.<sup>4</sup> The process of human digestion is divided anatomically into four processing stages, namely the oral, gastric, intestinal and fermentation in the large intestine, with independent and interdependent roles in the digestive process that begins in the oral cavity, preparing the food into smaller pieces and mixing it with saliva along with thermal regulation and allow salivary enzymes that have links to the metabolic and catabolic process. The salivary enzymes are  $\alpha$ -amylase detected most abundantly playing a role in physiological pre-absorption role of starch followed by lipase, peptidase and hydrolase.<sup>5, 6</sup> The other important determinants are the anatomy of the jaws, size of the jaws and the integrity of the

occlusion in mastication and these can be affected by dental caries, malocclusion, and developmental anomalies.<sup>7</sup>

An efficient intake of nutrition is facilitated by the process of mastication and there also exists a bi directional relationship with natal and post natal deficiencies of vitamin D, vitamin C, vitamin B and vitamin A and Protein Energy Malnutrition (PEM) have been associated with the disturbances in the oral structures. Protein deficiency has been associated with delayed teeth eruption and tooth size discrepancies. Vitamin A deficiency has been related to enamel hypoplasia and impaired tooth formation with Vitamin D or Calcium deficiencies showing hypomineralization and compromised tooth integrity such Enamel hypoplasia that is characterized by hypoplastic grooves and/or pits in the enamel, which are often horizontal or linear in appearance. Vitamin C deficiency has an effect on dentin formation<sup>3, 8</sup>.

### Systemic Effects

Psoter W *et al* (2008) evaluated the effect of dental caries on Early Childhood Protein Energy Malnutrition in 498 children aged between 11 to 13 years. The results showed that delayed exfoliation and eruption of the permanent teeth were associated with early childhood protein energy malnutrition due to nutritional deficiency in childhood. Delay in exfoliation of primary dentition was also associated with malnutrition experiences and could be related to the masticatory inefficiency.<sup>9</sup> Gaur S and Nayak (2011) aimed to evaluate the effect of S-ECC on the growth parameters and Quality of Life by comparing two groups of children with and without S-ECC. The groups comprising of 50 children each showed that dental caries had a direct effect on growth and quality of life due to the debilitating effect of the pain and discomfort that affects dietary intake leading to malnutrition<sup>10</sup> Bansal *et al* (2016) evaluated the effect of Severe Early Childhood Caries (S-ECC) by comparing two groups of 30 children each with and without S- ECC to determine its effect on body weight and quality of life. The presence of Iron Deficiency Anaemia also another outcome that were compared between the groups. The results revealed that 43% of children with S-ECC had iron deficiency anaemia with a majority having a moderate quality of life which was related to trouble sleeping or even eating foods. There was a significant impact on mental health and social functioning in children with the majority also being

underweight, the finding which has been seen in similar studies. The importance of this study being one of the few studies that establish a relationship between Iron deficiency and dental caries. <sup>11</sup> So *et al* (2017) in a study comprising of 1407 children with an age range of 6 months to 6 years, the experience of oral discomfort was recorded using a four point Likert scale. For the purpose of the study a cut-off criteria was designed based on the depth of the carious lesion in children with S- ECC and it was termed as Severe Caries (SC) with a distinct cavitation in either the dentinal or pulpal level. The nutritional level was recorded based on the WHO growth reference charts. The results showed that 65.4% of children had dental caries and 44.7 had SC. When compared with children with no mouth pain children with mouth pain showed increased tendencies to be underweight especially in the 3-6 year age groups. Effect of mouth pain also showed that disturbances in quality of sleep can be a cause for being underweight or obesity in children. <sup>12</sup>

Musso *et al* (2018) encountered a 3.5 year old child with recurrent complaint of abdominal pains. Clinical examination included oral examination that showed enamel hypoplasia with well demarcated opacities. A diagnosis of celiac disease that is an immune mediated, was made and enamel defects were seen in 60% of the patients diagnosed and delayed dentition is a marker for early diagnosis of celiac disease and the presence of enamel defects is a complementary tool for the diagnosis of atypical celiac disease. (13) Dimaisip - Nabuab J *et al* (2018) in a longitudinal cohort study comprising of 1499 children with a mean base line age of 6.7 years aimed to assess the association between dental caries and its effect on the nutritional status that included the parameters of weight and growth over a period of two years. The dental caries and odontogenic infections were recorded WHO criteria and pufa-index in both the primary and permanent dentition. Results showed the prevalence of dental caries and odontogenic infections in the primary dentition was 94.4% and 69.2%, respectively. Untreated dental caries in six to seven year olds were associated with underweight and growth retardation. <sup>14</sup> Renggli *et al* (2021) in a longitudinal study of 1307 children less than two years of age at baseline showed that children

with a severe caries index had twice the odds of developing chronic malocclusion. The results were in alignment with certain cross sectional and longitudinal studies with a positive association between dental caries and difference forms of malnutrition. The study highlights the need to prevent and treat early childhood tooth decay as an important part of programmes to prevent child malnutrition as well as Non communicable diseases, and to promote children's optimal growth and development during a critical stage of life. <sup>15</sup> The beginning process or the predisposition to caries formation is the demineralization stage and dissolution of the organic portion, enhanced by the increased presence of plaque that is a unique biofilm potentiating the process of caries formation due to increase of carbohydrates being one of the causes. <sup>16, 17</sup> The digestion of carbohydrates begins in the mouth by the action of salivary amylase on starches and further breakdown into monosaccharides that get absorbed in the intestine to the blood stream. Carbohydrates form the basis of nutrition and limitations lead to reduced nutrition and the discomfort of oral pain leads to sleep disturbances impairing the secretion of growth hormones being a direct action. Indirectly inflammation causes release of inflammatory cytokines such Interleukin -1 that affects erythropoiesis decreasing haemoglobin levels. Reduced sleep can also direct the energy available for growth leading to activation of hormones such as leptin and ghrelin that can affect appetite, reducing food consumption. <sup>19, 20, 21</sup> The effect of malnutrition is a bidirectional relationship considering the study by Vieira KA *et al* (2020) in a group of children aged 1 – 5 years, showing decreased salivary flow and buffering capacity correlating with malnourishment and this in turn being a risk factor for the formation of dental caries. <sup>22</sup>

## CONCLUSION

A balanced diet capable of providing adequate nutrition contributes to a desirable oral health status. Therefore, inadequate nutrition and the ingestion of specific foods exert an influence on the oral cavity.

In general untreated dental caries in young children has a direct and indirect effects. The carious process in

children is termed as ECC and the literature show the following main effects, Nutritional deficiency anaemia, Growth and development reduction and Oral Health Related Quality of Life being significantly affected.<sup>23</sup>

Literature available has been more abundantly limited to measurements of growth and Iron deficiency considering the need for invasive methods in the detection of nutritional deficiencies, yet it is important to note that dental caries is a multifactorial disease and the risk factors associated with the effects are as important as those with cause of it. When the oral pain is encountered there is a more preference towards supplements that are in turn cariogenic considering the sugars present worsening the oral situation especially when there is a long term use of dietary supplements. Thus it can be concluded that efficient absorption of nutrition is dependent on the masticatory process, dietary evaluation must include an oral examination. Interceptive orthodontics in children will also play a key role in the correction of developing malocclusion therefore a multidisciplinary approach comprising of the Pediatrician, Pediatric Dentist and the Nutrition Specialist will play a key role in the prevention of malnutrition in Children.

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