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Original Research Article

Crowding, Spacing and closed dentition in Primary Dentition and its relationship with BMI among Saudi Children

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Abstract: Obesity in childhood is associated with an increased risk for many adverse physical and psychosocial health outcomes. Due to more sedentary lifestyles and inadequate dietary habits, obesity has become an increasing problem in pediatrics. One of the reliable and accepted means to determine nutritional status is by Body Mass Index. Childhood Body Mass Index significantly changes with age. And it is a known fact that there is a strong correlation between BMI and dental development. This study aims to assess spacing, crowding and closed dentition in Saudi Arabian school children less than six years of age with primary dentition and its co-relation with Body Mass Index. This is a cross-sectional study involving 200 school children. This study was conducted to investigate relationship in primary dentition between spacing, crowding and closed dentition with BMI among Saudi Arabian children and to assess their correlation if any. The study included school children below 6 years of age having all deciduous teeth. Of the 200 students screened below the age group of 6 years, spacing was present in 116 (58%). 124(62%) of the 200 children had absence of closed dentition. Crowding was absent in 192 (96%) children of the total 200 children screened. In correlation between spacing and BMI, spacing was absent in 52 (62%) of children with normal BMI and 32 (38%) of the children were in underweight, overweight and obese category. Closed dentition was present in 47 (62%) of children, 29 (32%) of the children were in underweight, overweight and obese category. Crowding was present in 5 (62%) of children and 3 (38%) of the children were in underweight. Practitioners should conduct regular obesity check in children. This would allow the early detection of weight gain and further counselling. The results of this study showed a weak correlation between BMI and spacing, closed and crowded dentition.
Keywords: Primary dentition, Crowding, Spacing, Malnutrition, Body Mass Index, Closed dentition

INTRODUCTION:

Primary dentition is believed to provide basis for studying occlusion and for predicting the occlusion of the permanent dentition [1]. Body Mass Index (BMI) can be used as a measurement scale for assessment of malnutrition in children [2]. Malnutrition is a multidimensional phenomenon. It encompasses two opposite, but equally serious problems, namely under-nutrition which results from relative or absolute reduction of essential nutrients, and over nutrition due to excessive essential nutrients [3]. Malnutrition has been linked to a reduction in the length of the skull base and jaw height [4]. This in turns leads to malocclusion. The understanding of the etiological factors causing malocclusion will certainly decrease its prevalence and thereby the financial aspects of treatment. Malocclusion may be related to genetically determined factors, environmental factors or more commonly a combination of both inherited and environmental factors acting together [5].

One of the reliable and accepted means to determine nutritional status is by BMI. BMI is used to estimate a healthy body weight based on height. BMI is an easy method of measurement and calculation which is the most widely used diagnostic tool to identify nutritional condition of a population, and it usually determines whether a person is underweight, healthy, overweight or

obese [6]. The prevalence of overweight and obesity in most developed and developing countries has been markedly increasing in recent years [7]. An increase in BMI percentile is associated with an increase in both dental and skeletal development [8]. Anomalies in tooth number, shape, and position may lead to the disturbances in maxillary and mandibular arch length and occlusion complicating orthodontic treatment planning. Evidence suggests that energy-protein malnutrition is associated with impaired growth and development of bones [9].

There is a significant relation between crowding, facial heights, adverse oral habit and nutritional status which might be modulated by other local factors [3]. Malnutrition changes the growth pattern of the bones of the skeleton, including the face and oral cavity. This in turn leads to stunting. Stunting effects, the height of mandible, height of lower face and width of dental arches [10-13]. It is thus reasonable to hypothesize that low BMI can be associated with the restricted growth/development of the bones of the face and can change the amount of interdental spacing in deciduous dentition. Development is certainly a complex phenomenon and development changes in the jaws and teeth are modulated by a wide range of etiological factors. While BMI encompasses just one co-relation with malocclusion, it definitely is not the only factor affecting. This study aims to establish a co-relation between BMI and malocclusion in terms of spacing, crowding and closed dentition by assessing 200 school children.

MATERIAL & METHODS:

This is a cross-sectional study involving 200 school children. This study was conducted to investigate relationship in primary dentition between spacing, crowding and closed dentition with BMI among Saudi Arabian children and to assess their correlation if any. The study included school children below 6 years of age having all deciduous teeth. Subjects with abnormalities like presence of non-vital teeth, supernumerary/supplemental teeth, fusion, missing teeth, rampant caries and nursing bottle caries were excluded in the study. Eruption of any permanent Ist molar, incisor tooth was also excluded from the study sample.

Periodic oral screening program was conducted to assess spacing, crowding and closed dentition in relation to the primary dentition. Apart from the demographic data, the child's height in centimeters and weight in kilograms was recorded. Body Mass Index (BMI) was calculated with these recorded parameters. BMI was calculated by dividing the weight by squared height: BMI= mass (Kg) / (height $(m)^2$) according to the standardized Center of Disease Control (CDC) growth chart for children. Once a BMI percentile is calculated, the children were categorized using BMI table for children as follows:

BMI Table for Children

Weight Status Category	Percentile Range
Underweight	Less than the 5^{th} percentile
Healthy weight	5^{th} percentile to less than the 85^{th} percentile
Overweight	85^{th} to less than 95^{th} percentile
Obese	Equal or greater than 95^{th} percentile

Random sampling was done and results were displayed as frequency charts and graphs.

RESULTS:

Of the 359 students screened below the age group of 6 years, a total of 200 school children met with the inclusion criteria. Of the 200 children, spacing was present in 116 (58%) as shown in Table 1. As shown in Table 1, of the 116 children with spacing, 5(4%) were in underweight category, 99 (85%) were in the normal category, 7 (6%) were overweight and 5 were in the obese category (4%).

84 (42%) of the 200 children had no spacing as shown in table 1. 22 (26%) were in the underweight category. 52 (62%) were in the normal category, 7(8%) were overweight category and 3(4%) were in the obese category. In correlation between spacing and BMI, spacing was absent in 52 (62%) of children with normal BMI and 32 (38%) of the children were in underweight, overweight and obese category.

As shown in table 2, closed dentition was seen in 76 (38%) children out of the total 200 screened. Of the 76 children, 19 (25%) were underweight, 47(62%) in normal category, 7(9%) as overweight and 3 (4%) as obese. 124(62%) of the 200 children had absence of closed dentition. 8 (6%) of these children were in the underweight category, 104(84%) in the normal category, 7(6%) in overweight category and 5(4%) in obese category. In correlation between closed dentition and BMI, closed dentition was present in 47 (62%) of children with normal BMI and 29 (32%) of the children were in underweight, overweight and obese category.

As shown in table 3, Crowding was seen in 8 (4%) of the total 200 children. 3(38%) of these children with crowding were in the underweight category, 5 (62%) in the normal category, none were in the overweight and obese category. Crowding was absent in 192 (96%) children of the total 200 children screened. Out of these 192 children with absence of crowding, 24(13%) were

in the underweight category, 146 (76%) were normal, 14(7) in the overweight category and 8 (4%) were obese. In correlation between crowding and BMI, crowding was present in 5 (62%) of children with normal BMI and 3 (38%) of the children were in underweight, and none of the children were there in the overweight and obese category.

Table-1: Correlation of Spacing with BMI

SPACING	BMI				Total
	UNDERWEIGHT	NORMAL	OVERWEIGHT	OBESE	
ABSENT n (%)	22 (26)	52 (62)	7 (8)	3 (4)	84 (42)
PRESENT n (%)	5 (4)	99 (85)	7 (6)	5 (4)	116 (58)
Total	27	151	14	8	200

Table-2: Correlation of Closed Dentition with BMI

CLOSED	BMI				Total
	UNDERWEIGHT	NORMAL	OVERWEIGHT	OBESE	
ABSENT n (%)	8 (6)	104 (84)	7 (6)	5 (4)	124 (62)
PRESENT n (%)	19 (25)	47 (62)	7 (9)	3 (4)	76 (38)
Total	27	151	14	8	200

Table-3: Correlation of Crowding with BMI

CROWDING	BMI				Total
	UNDERWEIGHT	NORMAL	OVERWEIGHT	OBESE	
ABSENT n (%)	24 (6)	148 (84)	14 (6)	8 (4)	192(96)
PRESENT n (%)	3 (38)	5 (62)	0	0	8 (4)
Total	27	151	14	8	200

DISCUSSION:

The nutritional status of a child has implications on the physical, mental and emotional growth. It also has a significant impact on the society and reflects the dietary and social habits of a country. Moreover, the economic balance of the country and its population is reflected in the nutritional status. Underdeveloped countries struggle to provide a nutritional balance to the needs of a child. As such, the child develops with less psychological, physical competence as compared to others. Apart from genetic (osteopetrosis, osteopatha strara with cranial sclerosis) and hormonal influences (adrenal and thyroid disorders), nutritional status of the child has a significant impact on tooth development. While malnutrition is at one end of the spectrum, obesity is at the other end with its own related problems of growth, systemic diseases.

There is a strong co-relation between obesity and the order of tooth emergence as this may also impact oral health [14]. Tooth eruption is defined as the movement of a tooth from its site of development within the jaws to its position of function within the oral cavity [15]. Variation in the normal eruption of teeth is a common finding, but significant deviation from established norms should alert the clinician to take some diagnostic procedures in order to evaluate patient health and development. Disturbance in tooth eruption time could be a symptom of general condition or indication of altered physiology and craniofacial development [16]. Chronic malnutrition extending beyond the early childhood is correlated with delayed teeth eruption [17]. Obesity in childhood is associated with an increased risk for many adverse physical and psychosocial health outcomes. Due to more sedentary lifestyles and inadequate dietary habits, obesity has become an increasing problem in pediatrics [18].

Anbiaee N *et al.;* conducted a study to evaluate the relationship between the body mass index (BMI) and dental development involving 196 children. Results of their study showed that there was a significant correlation between BMI and dental development in girls whereas this was missing in boys [19]. Thomaz Erika B.A.F *et al.*, conducted a cross sectional study involving 2060 students of Brazil. According to them, there is no association between underweight and crowding and malnutrition is related to crowding in permanent dentition among mouth-breathing adolescents. Must A *et al.*, conducted a study to examine the association between obesity and tooth eruption. Their sample included data from three consecutive cycles of the National Health and Nutrition Examination Survey (NHANES) and analyzed to examine associations between the number of teeth erupted and obesity status among children of 5 to 14 years of age. They concluded that teeth of obese children erupted 1.44 times earlier than non-obese children [14]. Singh T *et al.,* conducted a cross-sectional study to assess the association between interdental spacing and BMI involving 392 children in the age group of 3 to 5 years. According to them, there is a statistically significant association between interdental spacing and BMI [1].

Suma G and Das UM conducted a similar study to assess crowding, spacing and closed dentition and its relationship with malocclusion in primary dentition among Indian population [20]. According to their results, spaced dentition was more frequent than closed or crowding in children below 6 years of age with primary dentition. The results of this present study co-relates with their finding as spacing was more frequently seen in this study also involving Saudi Arabian population. However, Suma G and Das UM did not co-relate BMI with spacing, crowding and closed dentition. In the present study, a more specific categorization has been done as underweight, normal, overweight and obese children and a co-relation has been done with the BMI. In children under six years of age presenting with primary dentition, closed dentition would be presumptive of malocclusion as the dentition develops. In the present study, 62% had absence of closed dentition which can be interpreted as developing with normal occlusal pattern. Absence of crowding in children under 6 years of age is considered as a normal eruption and occlusal pattern. The findings of the present study suggest that 96% of the children had lack of crowding which reflects a normal developing pattern. These findings also suggest lack of para functional habits. However, a more thorough evaluation needs to be performed to rule out para functional habits. But, the results of this study strongly suggest that there is a definite correlation between BMI and spacing, crowding and closed dentition.

CONCLUSIONS:

- Spacing was present in 58% of the children. The study also suggests absence of closed dentition and crowding in the majority of the subjects.
- Practitioners should conduct regular obesity. This would allow the early detection of weight gain and further counselling.
- Pediatric dentists, Community health care providers, Oral Diagnosis screening plays a prominent role in promoting oral and physical health. Regular checkups should include obesity screenings and diet counseling to prevent obesity as well as dental caries.
- In correlation between spacing and BMI, spacing was absent in 52 (62%) of children with normal BMI and 32 (38%) of the children were in underweight, overweight and obese category.
- Closed dentition was present in 47 (62%) of children with normal BMI and 29 (32%) of the children were in underweight, overweight and obese category.
- Crowding was present in 5 (62%) of children with normal BMI and 3 (38%) of the children were in underweight, and none of the children were there in the overweight and obese category.
- The results of this study showed a weak correlation between BMI and spacing, closed and crowded dentition.
- A more prospective long term study involving a larger sample size is suggested.

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