Assessment of relationship between body mass index (BMI) and dental development

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ABSTRACT:

INTRODUCTION- As hereditary, functional, environmental, sexual, nutritional and metabolic factors influence normal growth and development. Considering, the prevalence of malnutrition in children's. Body Mass Index (BMI) is a reliable index that is widely accepted within professional groups as the 'gold standard' for determining whether a child is underweight or overweight. Dental development is used as indices of growth and maturation during childhood since teeth develop and erupt in characteristic sequences and within predictable changes. As Nutritional deprivation is known to affect most body systems in the growing child. This study was conducted to evaluate the relationship between the body mass index (BMI) and dental development.

MATERIALS AND METHODS: The study was conducted in 120 children's who came for treatment in saveetha dental college, Chennai. Occlusal traits were recorded using Angle's classification of malocclusion and skeletal development following which their BMI was calculated by measuring their height and weight according to the metric standards.

RESULTS: The results of this study proved that there is increased prevalence of malocclusion in children with underweight BMI than those with normal BMI. The prevalence of malocclusion in underweight children with Class I (60 percent), Class II (19.1 percent), class III (3.3 percent) was found significant than the children with normal BMI with Class I (13.3 percent), Class II (3.3 percent), Class III (0.8 percent).

CONCLUSION - Dental age and dental development are important issues in orthodontics. Delays in the appearance of permanent teeth, is a concern for many parents, both genetic and environmental factors may affect dental development. BMI is one of the factors thought to be related to dental development. Accelerated dental development in children is an important variable to consider in pediatric dental and orthodontic treatment planning where timing is crucial.

KEYWORDS: Body Mass Index (BMI), dental development, orthodontic, occclusal traits, treatment planning.

INTRODUCTION:

The prevalence of malnutrition in developing countries like India has been markedly increasing in recent years. This is most commonly seen among children's of both genders, ages, racial, ethnic groups, and educational levels. Considering the increased prevalence of malnutrition, there is a need for information about its possible effect on dental development on a cross-sectional study.(1) As hereditary, functional, environmental, sexual, nutritional and metabolic factors influence normal growth and development. Considering, the prevalence of malnutrition in children's.(2) Body Mass Index (BMI) is a reliable index that is widely accepted within professional groups as the 'gold standard' for determining whether a child is underweight or overweight. BMI is

calculated from weight (kg) divided by the square of height (m). Reference ranges have been defined according to the extent of adiposity and the level of morbidity risk. The World Health Organization (1998) classifies normal weight as a BMI of 18. 5–24. 9 kg/m2, overweight as 25–29. 9 kg/m2 and obesity as ‡30 kg/m2. Although BMI is almost universally used to describe obesity, it has also been extrapolated to describe extents of undernutrition; a BMI of <18. 5 kg/m2 is considered underweight and hence indicates undernutrition. The scientific basis of this extrapolation and the evidence to support the use of BMI in defining under nutrition is unclear.(3) Malnutrition in children can lead to skeletal problems in the head and neck region like cervical osteoporosis, osteopenia etc. BMI is dependent on age and gender in children and adolescents and is generally referred to as specific for a certain age.(1) Dental development are used as indices of growth and maturation during childhood since teeth develop and erupt in characteristic sequences and within predictable changes.(2) Dental development is integral in sustaining and maintaining the quality of life in humans. Nutritional deprivation is known to affect most body systems in the growing child. Human teeth develop as individual units and follow a sequence over a long period of time (over 20 years) during which they fully erupt into the mouth. Measuring tooth growth in living humans can be done by assessing their formation (crown and root stages), maturity (assessing overall tooth formation) and/or eruption (counting the number of teeth in the mouth) in relation to chronological age. There is considerable normal variation in age between individuals for the same tooth stage. The effect of nutrition on tooth formation and eruption has been investigated in a variety of ways which do not lend themselves to being compared. Past studies quantifying the effect of malnutrition on the timing of tooth formation have led to inconsistent and conflicting conclusions. Several methods investigating tooth formation and/or eruption in relation to malnutrition measured dental maturity ought to have a greater negative impact on skeletal development than growing teeth.(4) There are several methods that may be used to evaluate, describe and classify occlusion. These can be classified basically as qualitative and quantitative. Qualitative variables define only the presence or absence of a selected malocclusion criterion. A series of malocclusion studies have been undertaken using qualitative methods of assessment. The most examined topics are antero-posterior relationships. Angle’s classification has been widely used as a qualitative epidemiological tool for malocclusion assessment. Hence, Angle’s classification of malocclusion was used to identify if there is any variation from normal in the process of dental development.(5) Assessment of skeletal maturity is an important method in the evaluation, follow up, and timing of therapy in children with growth disorders, such as constitutional growth retardation and growth hormone deficiency, as well as endocrinological diseases, such as hypothyroidism, congenital adrenal hyperplasia, and precocious puberty.(6) This is a continuum ranging from an ideal occlusion to considerable deviation from normal leading to differences in classification of occlusal relationships, the developmental status of the cohort, and differences in determining the boundaries of normal occlusion.(7) which is a manifestation of morphological variations that are related to the development of the dentition.(8) Quantitative methods of recording and occlusal features are important for epidemiologists and for those planning the provision of orthodontic services in a certain community. Untreated malocclusion may lead to mandibular dysfunction and severe psychological problems.(9) Therefore, rational planning of orthodontic measures on these basis is essential in assessing the resources required for such services.(8) Since, Most developmental parameters are clearly and unequivocally affected by extremes of nutrition. Fat children, for example, grow faster, mature earlier, and have advanced bone ages and earlier epiphyseal union.(10) the early prevention and interception of dentofacial deformities is depended upon an accurate interpretation of the inherent facioskeleton pattern and overall growth and development.(2) The aim of the present study was to assess the inter-relationship between BMI and occlusal traits, a concern for dental development. As any form of deviation in dental development in children is an important variable to consider for orthodontic treatment planning where timing is crucial.

SUBJECTS AND METHODS:

The sample consisted of 120 children who were undergoing treatment in saveetha dental college and hospitals. The criteria for selection were:

1. Participants must be under the age group of 7 to 16 years

2. They must be free of any serious illness and have no history of trauma or surgery that could affect occlusion.

3. They must have not had extraction of any permanent teeth.

EXCLUSION CRIRETIA:

i) Children who had previously had any kind of orthodontic treatment were excluded from the study.

ii). Children with clefts, syndromes, and systemic health disease were not included in the study.

METHOD AND MATERIALS: The clinical examination of each participant was carried out. The occlusal status was then evaluated. There are several methods that may be used to evaluate, describe and classify occlusion. These can be classified basically as qualitative and quantitative. Qualitative variables define only the presence or absence of a selected malocclusion criterion. The most common relationship that was examined is antero-posterior relationship using Angle’s classification of malocclusion and skeletal development. In 1890 Edward H. Angle published the first classification of malocclusion. The classifications are based on the relationship of the mesiobuccal cusp of the maxillary first molar and the buccal groove of the mandibular first molar:

Class I - The mesiobuccal cusp of the maxillary first permanent molar occludes with the mesiobuccal groove of the mandibular first permanent molar. If this molar relationship exists then the teeth can align into normal occlusion.

Class II - The molar relationship shows the mesiobuccal cusp of the permanent maxillary first molar occludes mesial to the buccal groove of the permanent mandibular first molar. That is, the mesiobuccal groove of the mandibular first molar is DISTALLY (posteriorly) positioned when in occlusion with the mesiobuccal cusp of the maxillary first molar. Usually the mesiobuccal cusp of maxillary first molar rests in between the first mandibular molar and second premolar. The

Class II Malocclusion has 2 subtypes to describe the position of anterior teeth:

• Class II Division 1: The molar relationships are like that of Class II and the maxillary anterior teeth are protruded. Teeth are proclaimed and a large overjet is present.

• Class II Division 2: The molar relationships are Class II where the maxillary central incisors are retroclined. The maxillary lateral incisor teeth may be proclaimed or normally inclined. Retroclined and a deep overbite exists.

Class III - The mesiobuccal cusp of the maxillary first permanent molar occludes DISTALLY (posteriorly) to the mesiobuccal groove of the mandibular first molar.

After obtaining the occlusal relationships, their height and weight was measured according to the metric standards The patients' weights (kg) were measured to the nearest 0.1 kg using a mechanical scale and their heights (cm) using a wall mounted stadiometer. Then BMI was calculated and compared with the respective age and gender charts. According to the international BMI standards, children with BMI below 5% of standard were considered as thin or underweight, between 5% - 85% as normal and above 85% as obese.(1) The materials used for examination includes:

- Disposable dental mirrors and probes
- A measuring tape
- And a weighing scale

RESULTS:

The subjects were broadly divided into patients with Normal BMI and patients with Underweight BMI and there occlusal traits and skeletal development were classified according to Angle's classification of malocclusion.

As will be noted from Table-1, In subjects with Normal BMI Class I malocclusion was found in 16 subjects, which represented 13.3% of the 120 individuals examined. Class II malocclusion was diagnosed in 4 patients of the 120 with 2.5% of all patients were Class II Sub Division I and 0.8% of all patients were Class II Sub Division II. Class III malocclusion was found in 1 patient among 120 subjects which constitutes about 0.8% of the total. Where as in subjects with Underweight BMI, Class I malocclusion was more prevalent and were found in 72 individuals of the 120 which constitutes 60% of the total individuals examined. Class II malocclusion was found in 23 individuals of the 120 with 14.1% of all patients were Class II Sub Division I and 5% of all patients were Class II Sub Division II. Class III malocclusion was found in 4 patients of the 120 which constitutes about 3.3% of the total.

Further, there skeletal classifications were examined. About 88 individuals of the 120 patients had Class I skeletal development, 27 individuals had Class II skeletal development and about 5 patients had Class III skeletal development.

OCCLUSAL ANTEROPOSTERIOR RELATIONSHIPS	NORMAL BMI		UNDERWEIGHT BMI	
	n	%	n	%
Class I	16	13.3	72	60
Class II-sub division 1	3	2.5	17	14.1
Class II-Sub division 2	1	0.8	6	5
Class III	1	0.8	4	3.3

Table-1 Occlucal Classifications

DISCUSSION:

The purpose of this cross-sectional study was to provide the oral health care planners with adequate information about the prevalence of malocclusion among the age group (7-16 years) that most often seeks orthodontic treatment. Although assessment of occlusion in non-growing and permanent dentition periods is more reliable, this range was chosen for two reasons: it represents the majority of candidates for orthodontic treatment, and second, studying occlusion in the mixed dentition period could modify treatment plans for preventive or interceptive treatment before growth is completed. Another focus of this study was to assess the correlation between the different categories of BMI-for-age and dental maturity. Age and gender specific BMI values for children are referred to as "BMI-for-age". BMI-for-age is adopted by the World Health Organization as the most specific nutritional status evaluation method. The categories describing body fat for children and teenagers are also different from categories describing adult body fat. It includes underweight, normal-weight, at risk of underweight and overweight, but there is no obese category for children. (11)

Although many studies have been published that describe the prevalence and types of malocclusion, it is difficult to compare and contrast these findings; in part, because of the varying methods and indices used to assess and record occlusal relationships, age differences of the study populations, examiner subjectivity, specific objectives, and differing sample sizes. The method used in this study was collected from different studies. Our results will be discussed with the findings from other geological regions. Although Angle's classification is limited in that it is reliable and repeatable and minimizes examiner subjectivity.(5) In this study, Class I malocclusion was found prevalent in underweight children's (60 percent) than in children's with normal BMI (13.3 percent). Similar trends were seen in Onyeaso study which found that Class I malocclusion was more common in Nigerian adolescents (50%). In a study by Silva and Kang, Latin adolescents demonstrated a higher rate of Class I malocclusion of 69.4%. In the present study, Class II malocclusion in underweight children were found in 19.1 per cent (14.1 per cent division 1 and 5 per cent division 2) which was found prevalent when compared with children's with normal BMI 3.3 percent (2.5 percent in division 1and 0.8 percent in division 2) similar to the rates reported by Onyeaso et al 15 (12.3%), Thilander et al 16 (14.9%), Haynes et al 17 (12.5%), Silva and Kang et al 18 (20.3%), and Foster and Day et al 19 (27.2%). Compared with the data from the American, Asian, Australian, and European populations, the Anatolian sample also showed a relatively high prevalence of Class II malocclusions. Lauc et al 20 found that Class II malocclusion was more common in their population (45.1%), and explained this figure by a genetic influence on the incidence of Class II malocclusions. The prevalence of Class III in underweight children was more significant with 3.3 percent than the children with normal BMI with 0.8 percent. Which is very close to is very close to the rates determined by Silva and Kang and Onyeaso, 9.1% and 11.8%, respectively. However, Goose et al 21 (2.91%), Haynes et al 17 (2.5%), Foster and Day et al 19 (3.5%), Proffit et al 22 (5.7%), Thilander et al 16 (5.8%) and Lauc et al 20 (4.8%) reported lower rates.(5)

The Prevalence of malocclusion in the children studied is shown (Table 1) according to BMI and Angle classification proved that approximately one-third of the children less than 10 years of age had some form of malocclusion according to the criteria used; the proportion increased continuously until, by age 13, approximately three-fourths had malocclusion. The characteristics responsible for this categorizing were not constant for BMI. For example, malocclusion caused by mesial drifting of a molar was more frequently observed in the older children. In many, this was the result of premature tooth loss. (12) The number and severity of malocclusal traits may reflect the need and demand for orthodontic treatment in individuals. As the need of orthodontic treatment in different populations and cultures, there are usually several levels of treatment need based on socio-economic and or ethnic differences which have great impact on BMI. Thus, preventive programs and early detection of caries are still the best means of reducing high prevalence of malocclusion traits, especially crowding. As poor health partly explains the high prevalence of malocclusion.(8) A proper prophylactic oral hygiene programme is of greatest importance for this population and such a programme will reduce the prevalence of malocclusion such as cross-bite, open-bite, occlusal interferences, prominent overjet ,overbite and crowding.(13) hence, It is the responsibility of parents to pursue health-related necessities of their children. In this regard, the lack of parent's or guardian's attention will have a negative influence on the child's oral status.(14)

CONCLUSION:

The results of this study show that there is increased prevalence of malocclusion in patients with underweight BMI than with normal BMI which demonstrates accelerated dental development in patients with low BMI. Thus, providing the orthodontist an opportunity to measure weight and height as a diagnostic record for orthodontic treatment planning. However, further studies are required to clarify the findings and to provide accurate estimates of the orthodontic treatment.

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