

Child obesity and dentistry

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Abstract

Childhood obesity is one of the fastest growing epidemics in the world. It used to be a problem limited to developed countries but has slowly, but surely, made its way into developing nations. 7 out of 10 children nowadays are overweight, if not obese. Obesity not only affects systemic, but also dental health negatively. Since the biggest contributor to this problem is diet, dentist are in a unique position to not only monitor but also control childhood obesity. In this article, there is description of various problems faced by an obese person and the various ways in which a dentist can help them.

Keywords: Childhood obesity, Causes, Consequences, Dental problems, Dental considerations.

Introduction

Childhood or pediatric obesity is a condition in which a child is significantly overweight for his/her age and height.¹ It may sound innocuous but the truth is that child obesity is one of the fastest growing epidemics in today's day and age. Nearly 2.1 billion people i.e. 30% of the world's population is chronically obese.² Although there has never been a set definition for childhood obesity, its most identifiable feature is body fat. Body fat measurement can be done in a variety of ways such as underwater weighing (densitometry), multi-frequency bioelectrical impedance analysis (BIA), and magnetic resonance imaging (MRI). In the clinical environment, techniques such as BMI, waist circumference, and skin-fold thickness are used. Waist circumference seems to be more accurate for children because it targets central obesity, which is a risk factor for type II diabetes and coronary heart disease. Although BMI is very inaccurate when it comes to children, as it fails to account for the different growth phases of a child; neither does it differentiate between fat and muscle mass.³

Causes of childhood obesity:⁴

1. Genetic, perinatal and early life factors: Researchers have identified 5 genetic mutations that cause human obesity, all presenting in childhood including a mutation in the gene encoding leptin, a hormone normally produced by adipocytes and secreted in proportion to body-fat mass.

According to Whitaker and Dietz's hypothesis, maternal obesity increases transfer of nutrients across the placenta, inducing permanent changes in appetite, neuroendocrine functioning, or energy metabolism which shows a direct relation between maternal obesity, birthweight, and obesity later in life.

During early childhood, BMI normally decreases until age 5–6 years, then increases through adolescence. The age at which this BMI nadir occurs has been

termed the adiposity rebound. Early adiposity rebound can cause higher risk for later obesity.

2. Physical activity: A lifestyle characterized by lack of physical activity and excessive inactivity (particularly television viewing) might cause obesity in children. Physical activity is inversely associated with BMI change in kids. Television viewing promotes weight gain not only by displacing physical activity, but also by increasing energy intake. Children passively consume excessive amounts of energy dense foods while watching television. Furthermore, television viewing during mealtime is also inversely associated with consumption of products not typically advertised, such as fruits and vegetables, causing obesity.
3. Diet
 - a. Fat is the most energy dense macronutrient, excessive consumption of which is often believed to cause weight gain. However, the prevalence of obesity has increased, despite an apparent decrease in consumption of fat in the diet. Type of dietary fat is of greater importance than total fat consumption in the cause of obesity-related morbidities. Intake of partially hydrogenated (Trans) fat, commonly found in commercial bakery products and fast foods, increases risk for both cardiovascular disease and type 2 diabetes in adults. By contrast, unsaturated fats from vegetables and marine sources decrease risk of these diseases.
 - b. Carbohydrate—The decrease in dietary fat consumption has been accompanied by a compensatory increase in carbohydrate consumption, especially in the form of refined foods—e.g., breads, cereals, potatoes, soft drinks, etc. High glycemic index foods like these produce large increases in postprandial blood glucose concentrations and induce hormonal events that

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stimulate hunger and cause overeating in adolescents. Sugary soft drinks promote energy intake and excessive weight gain because of their high glycemic index. By contrast, milk, a low glycemic index beverage, protects overweight young adults from becoming obese.

- c. Energy density—seems to affect satiety and food consumption, at least in the short term. Adults consume less energy when served test meals with a low, rather than a high energy density, irrespective of fat content. The energy density of children's diets is directly associated with not only fat but also a range of starchy foods, including breakfast cereal, bread, and potatoes.
 - d. Portion size—Studies have shown that as children grow older, they become less responsive to internal hunger and satiety cues and more reactive to environmental stimuli.
 - e. Fast food—The rise in consumption of fast food, in developed and developing nations, might have particular relevance to the childhood obesity epidemic. Fast food typically incorporates all of the potentially adverse dietary factors described above, including saturated and Trans fat, high glycemic index, high energy density, and, increasingly, large portion size. Additionally, these foods tend to be low in fiber, micronutrients, and antioxidants; dietary components that affect risk of cardiovascular disease and diabetes. A large fast food meal (double cheeseburger, French fries, soft drink, dessert) could contain 9200 kJ (2200 kcal), which, at 350 kJ (85 kcal) per mile, would require a full marathon to burn off.
4. Family factors: Parent-child interactions and the home environment can affect behaviors related to risk of obesity. Family life has changed a lot over the past two decades, with trends towards eating out and greater access to television than previously. Moreover, social support from parents and others correlates strongly with participation in physical activity.
 5. Psychological factors- obesity has been directly linked to psychological problems like depression and anxiety by many studies. People with depression tend to "eat their feelings". Hence, children with a difficult family/school life tend to be overweight as well.
 6. Socioeconomic factors- fast food, especially in today's world, is a lot cheaper and easily available than healthy and nutritious foods. Hence, a lot of times, children belonging to lower socioeconomic strata of society tend to buy cheaper, more easily available foods.^[5]

Consequences of obesity

Health consequences

Obesity is in itself a great risk as one of the forms of malnutrition is over nutrition, as it causes an excess or imbalance of energy, protein and micronutrients in diet. Childhood obesity can easily be linked to a myriad of health problems such as type 2 diabetes and coronary heart disease.

Obesity also leads to a cornucopia of diseases and health complications such as:

1. Growth: Overweight children tend to be taller, have advanced bone ages, and mature earlier than non-overweight children. Early maturation is associated with increased fatness in adulthood as well as with an increase in the truncal distribution of fat in women. Early maturation also may increase the likelihood of eating disorders such as anorexia and bulimia.
2. Hyperlipidemia: Increased blood lipids are common among obese children and adolescents. The characteristic pattern observed consists of elevated serum low-density lipoprotein (LDL) and lowered high-density lipoprotein levels. Central fat distribution is an important mediating variable between lipid levels and obesity. Increased free fatty acids produced by increased lipolysis by visceral adipocytes and hyperinsulinemia may promote hepatic triglyceride and LDL-cholesterol synthesis. Weight reduction has a beneficial effect on these cardiovascular risk factors.
3. Glucose intolerance: Obesity causes NIDDM (Non-Insulin Dependent Diabetes Mellitus) in adolescents. Visceral fat is related directly to basal insulin secretion, stimulated insulin secretion, and insulin resistance. The prevalence of Acanthosis nigricans among obese patients may be as high as 25%, which is typically a sign of diabetes.
4. Hepatic steatosis and cholelithiasis: High concentrations of liver enzymes are frequently observed in obese children and adolescents. Increase of liver enzymes is frequently associated with fatty liver, fatty hepatitis, fatty fibrosis, or cirrhosis. Hyperinsulinemia plays a role in the pathophysiology of steatohepatitis. Weight reduction induces a normalization of hepatic enzymes. Increased cholesterol synthesis and cholesterol saturation of bile occurs in obesity.^[6]
5. Metabolic syndrome: Metabolic syndrome is a condition characterized by a special constellation of reversible major risk factors for cardiovascular disease and type 2 diabetes. The main, diagnostic, components are reduced HDL-cholesterol, raised triglycerides, blood pressure and fasting plasma glucose, all of which are related to weight gain, specifically intra-abdominal/ectopic fat accumulation and a large waist circumference.⁷
6. Sub clinical inflammation: Obesity contributes to the development of vascular inflammation which raises markers of inflammation. High levels of C-reactive protein (CRP) denote future risk for development of T2DM and CHD. Excess dietary intake of saturated fat strongly correlates to high CRP levels.⁸
7. Hypertension: Hypertension occurs less frequently in children. Elevated blood pressure occurs approximately nine times more frequently among the obese. Childhood blood pressure and change in BMI are two most powerful predictors of adult blood pressure across all ages and both genders. It may cause hypertensive heart disease or cerebral hemorrhage. Hypertension appears

to be another consequence of hyperinsulinemia. Hyperinsulinemia produces a significant decrease in renal sodium retention in both obese and non-obese adolescents, and dietary therapy, particularly when it is accompanied by exercise, effectively decreases blood pressure

8. Pseudotumor cerebri: It is a rare disorder characterized by increased intracranial pressure. It presents with headaches and may lead to severe visual impairment or blindness. Up to 50% of children who present with this syndrome may be obese, but the onset of symptoms does not appear to correlate with weight gain. The potential for visual impairment indicates the need for aggressive treatment of obesity.
9. Sleep apnea: One third of obese children have a history of breathing difficulties during sleep were found to have apnea. Neurocognitive deficits are common among children with sleep apnea. Hypoventilation might be long term consequence of apnea.
10. Orthopedic complications⁸: Because the tensile strength of bone and cartilage did not evolve to carry substantial quantities of excess weight, obese children experience a variety of orthopedic complications like bowing of the tibia and femurs. The resultant overgrowth of the medial aspect of the proximal tibial metaphysis is known as Blount disease.
11. PCOS: Polycystic ovary syndrome (PCOS) is a condition that affects a woman's hormone levels during ages 15-44 yrs. Women with PCOS produce higher-than-normal amounts of male hormones. This hormone imbalance causes them to skip menstrual periods and makes it harder for them to get pregnant¹⁹ Up to 30% of women with PCOD may be obese. Hyperandrogenism and hyperinsulinemia frequently accompany the syndrome. The process of adolescent maturation appears ideally suited for the study of the relative contribution of body fatness, fat distribution, hyperandrogenemia, hyperinsulinemia, and PCOD.
12. Cancer: Obesity increases risk for several types of cancers like breast, uterine, esophageal, kidney and pancreatic due to long term inflammation caused by excess visceral fat deposition; which leads to increased insulin resistance and ultimately higher estrogen levels, that lead to increased cell reproduction, which may cause tumor growth.¹⁰
13. GERD: Increased belly fat causes pressure on stomach, causing hiatal hernia, causing backflow of stomach acid in obese children.

Social consequences

Generally overweight or 'chubby' children are considered to be healthy but when this chubbiness carries over to adolescence, it is considered awful and children are criticized, causing a feeling of low self-esteem and inadequacy to develop in them, which might cause them to develop eating disorders, like starving (anorexia) or overeating to induce vomiting (bulimia).

Dental problems¹¹

1. Periodontitis is a disease process that causes progressive destruction of the periodontal tissues, including the loss of gingival connective tissue, destruction of periodontium, and alveolar bone resorption. It is common among obese people because adipose tissue secretes chemical mediators of inflammation, including cytokines and hormones that modify the response of the periodontal tissues to the oral environment.¹² obese people have abnormal lipid parameters like significant increase in triglycerides. Overweight and obese people have elevated levels of peripheral serum lipids and indicators of periodontitis. Blood vessels of periodontium in obese people have thickenings on the most inner walls, which causes reduced blood flow which is one of the pathogenic mechanisms of the development of periodontal disease.
2. Dental caries is a chronic pathological condition, attacking mineralized structures of teeth, with a multifactorial but well understood etiology. Etiological chain of dental caries is obviously cariogenic microorganisms from dental plaque, mainly *Streptococcus mutans*, and socioeconomic and demographic factors, but obesity and dental caries are intrinsically linked due to dietary factors.¹³
3. The consequences of dental caries and periodontal disease can also lead to tooth loss, and obese individuals are associated with having fewer teeth than others. Partially or completely edentulous patients without dental prostheses are prone to be obese. Edentulousness serves as a contributing factor for poor dietary consumption, such as fewer vegetables and more cholesterol and saturated fat, which in turn favors weight gain.
4. Obesity has also been associated with surgical difficulty in third molar extraction and increased postsurgical extraction complications. These patients may present poor surgical visibility and accessibility for anesthesia and surgical procedures¹⁴ as the anatomical landmarks are hard to identify and the intramuscular injections are not given properly as the medicine might be delivered to fatty deposit.
5. The most common mucositis in obese patients is xerostomia (sensation of dry mouth), an alteration of the quantity or quality of saliva produced resulting in significant pain and burning sensation of the oral tissues. Obese patients may have increased susceptibility to dry mouth, particularly if they suffer from obstructive sleep apnea or take medications that alter saliva flow.¹⁵
6. Other than this, obese patients are difficult to treat as they may not find the dental chair comfortable, and may have problem with regular blood pressure cuffs. Also obese patients are more prone to chest discomfort and shortness of breath which makes them more susceptible to medical emergencies.

- Housebound patients that may be very obese are difficult to treat as a dentist cannot provide a home visit.

Dental considerations

Considering that weight status and its dietary correlates are related to dental health, the dental team has a unique opportunity address the epidemic of child obesity.

- Dentists may see children by 1 year old, providing an opportunity for longitudinal counseling, monitoring of weight status from an early age and anticipatory guidance about appropriate dietary habits, the importance of avoiding caloric-dense, low nutrition foods, and the consequences of non-ideal growth trajectories that lead to development of overweight or obesity.
- Dentists have a higher likelihood than pediatricians of seeing older children on a regular basis for recall visits and can utilize dental visits for additional screening and counseling that complements a physician's efforts in addressing overweight or obesity.
- Dentists are credible sources for dietary counseling and already counsel about caries prevention and could easily counsel to emphasize the implications of poor diet on oral and systemic health that extend well into adulthood.
- Some dentists currently measure children's weight and height for purposes like to calculate safe dosages of local anesthesia for young children, for most conscious sedation procedures or dental rehabilitation under general anesthesia. They can calculate and track BMI percentiles.¹⁶
- Dentists can refer of at-risk patients to a medical doctor or another health care professional if they observe major changes in body weight and/or dietary habits. Display (in the dental office) of posters showing the importance of healthy dietary habits, helps make patients aware of the importance of diet and its potential positive outcomes for oral health and body weight.¹⁷
- Oral-jaw wiring (OJW) or maxilla-mandibular fixation (MMF) has been applied in an effort to control obesity. The main indication for OJW is for stabilizing the jaws after dental or maxillofacial trauma. This technique is simple and can be realized in a dental clinic, and is considered as an integrated approach to obesity. Jaw wiring can be performed by dentists, orthodontists, and oral surgeons with the purpose of weight loss in obese individuals. This technique should not be applied for a period longer than 3 months. Jaw wiring seems to be safe but an ineffective means of controlling weight, especially if applied to the patient with poor motivation and immature personalities. The only limitation of OJW is regaining the lost weight.¹⁸
- Oral appliance: Dentists are involved in the team whose concern regarding the weight loss is not limited to wiring jaws but by interfering with making a retainer-like device that makes obese patients take smaller bites,

which is custom-made to fit the roof of the patient's mouth. The idea of this retainer came from the scientific finding that it takes 15–20 min for the brain to signal the stomach that it is full and to stop eating (Fast eaters can intake a lot of calories and slow eaters reduce the amount of caloric intake). The built-in system in the brain controls when we have had enough to eat; this is called satiety. It takes 20 min after eating before one feels satisfied or "full." As a result, eating too fast can lead to ingesting more than we need before the signal of "full" reaches the brain. The principle of the appliance is to slow down the eating process by making eating more difficult until the satiety response signal of full is achieved with less amount of food, leading the person to lose weight. The first design of this appliance is called the dental device system (DDS). In reducing the size of oral cavity, the patients are training to eat slowly with a small bites until they feel satisfied by the brain signal. It is a gradual behavior modification system that teaches the patient new ways to change their eating habits. DDS system was developed to arrive now to the new device which called sensor monitored alimentary restriction therapy (SMART). The only difference is that the SMART device has an electronic component that allows the patient to track the usage on a given day.¹⁹

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Conflict of Interest

None.

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