

# Body mass index and its association with oral disorders: A review

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## ABSTRACT

Obesity is a chronic disease with global epidemic spread. The world wide prevalence of obesity is a considerable source of concern given its potential impact on morbidity, mortality and cost of health care. The World Health Organization (WHO) has recognized obesity as a predisposing factor to measure chronic diseases ranging from cardiovascular diseases to cancer. Once considered a problem only in wealthy countries, WHO estimates overweight and obesity are now dramatically on the rise in low and middle income countries. The disturbing squeals of this increased trajectory of overweight populations are the parallel increases in chronic diseases that are co-morbidities of obesity. Primary health care providers, including dental professionals, are well-positioned to address this public health problem at the patient level. Dental professionals must be aware of the increasing numbers of the obese patients and of the significance of obesity as a multiple risk factor syndrome for oral and overall health. Dental professionals have a crucial role in the prevention and detection of many oral and systemic diseases because of their diagnostic and screening abilities as well as the frequency of patient visits. These invaluable skills and practice paradigms should be considered as part of the equation to solve one of the largest public health concerns of our time: the obesity epidemic. Ultimately, a health condition as prevalent and serious as obesity must be approached by a concerted and collaborative effort of many disciplines and organizations. The dental profession should include itself in this collaboration using the tools and education opportunities available. Although the connection between oral health and obesity is critical to understand, it should not be the sole motivating factor for taking action.

**Keywords:** Body mass index, body weight, body height, adipose tissue, overweight, morbidity, mortality.

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## INTRODUCTION

Obesity is a chronic disease with a global epidemic spread. The worldwide prevalence of obesity is a considerable source of concern given its potential impact

on morbidity, mortality and cost of health care. The World Health Organization (WHO) has recognized obesity as a predisposing factor to measure chronic diseases ranging

from cardiovascular diseases to cancer. Once considered a problem only in wealthy countries, WHO estimates show that overweight and obesity are now dramatically on the rise in low and middle income countries. The WHO estimates that over one billion people are overweight globally and that if current trends continue, this number will increase to 1.5 billion by 2015. This is due to a number of factors including a global shift in diet and a trend towards decreased physical activity due to the sedentary nature of modern work and transportation and increasing urbanisation. The disturbing squeals of this increased trajectory of overweight populations are the parallel increases in chronic diseases that are co-morbidities of obesity (WHO, 2005).

According to the WHO, obesity can be defined as an abnormal or, excessive level of fat accumulation that may impair health (WHO, 2011). Like many chronic diseases, obesity has significant associated morbidity, mortality and economic impact and is largely preventable (CDC, 2012). Primary health care providers, including dental professionals, are well-positioned to address this public health problem at the patient level. It is increasingly evident that the dental profession is a stakeholder in the weight status of its patients and can be part of a coordinated effort to prevent and intervene in the obesity problem. In 2010, WHO reported that approximately 43 million children younger than 5 years were overweight and that the distribution was no longer heavily skewed towards high income countries. Nearly 35 million overweight children are part of the developing world and 8 million are in developed nations (WHO, 2011). The same report states that 65% of the world's population lives in countries where overweight and obesity kill more people than underweight conditions. The onset of Type 2 diabetes mellitus (DM) in young children aged 6 to 11 had doubled in the past 20 years (Gerberding, 2007). Internationally, it was estimated in 2008 that 1.5 billion adults, 20 and older, were overweight. Of these, over 200 million men and nearly 300 million women were obese. It was concluded that more than 1 in 10 of the global adult population is considered obese, a trend that has developed in the past decade (WHO, 2011).

Demographically, 13.9% of people meet the adult classification of obesity with a body mass index (BMI) of 30 or greater. Furthermore, a study by Ritchie et al. found that a child who was overweight at any one point during the elementary school years was 25 times more likely to be overweight at age 12 than a child who was never previously overweight (Ritchie et al., 2005). It is predicted that 70% of overweight children become obese adults with all the chronic disease implications attached which underscores the importance of early intervention efforts (Serdula et al., 1993). National Health and Nutrition Examination Survey (NHANES) results from 2009 to 2010 found that more than one-third of adults were obese and there were no significant differences found between genders (Ogden et al., 2012).

Once considered a problem only in wealthy countries, WHO estimates overweight and obesity are now dramatically on the rise in low and middle income countries. The disturbing squeals of this increased trajectory of overweight populations are the parallel increases in chronic diseases that are co-morbidities of obesity. Primary health care providers, including dental professionals, are well-positioned to address this public health problem at the patient level. Dental professionals must be aware of the increasing numbers of obese patients and the significance of obesity as a multiple risk factor syndrome for oral and overall health. Although the connection between oral health and obesity is critical to understand, it should not be the sole motivating factor for taking action. The present review focuses on the possible implications obesity can have on oral and overall health and the possible role of dental professionals in combating this serious concern which is spreading like a menace in the present world.

### **BODY MASS INDEX (BMI) AND BMI PERCENTILE**

Body mass index is defined as an individual's body mass divided by the square of his or, her height. The formulae universally used in medicine produce a unit of measure of kg/m<sup>2</sup>.

$$\text{BMI} = \text{mass (kg)} / (\text{height (m)})^2$$

World Health Organization (WHO) regards a BMI of less than 18.5 as underweight and may indicate malnutrition, an eating disorder, or, some other health problems, while a BMI greater than 25 is considered overweight and above 30 is considered obese. These ranges of BMI values are valid only as statistical categories (WHO, 2006).

### **BODY MASS INDEX (BMI) FOR CHILDREN**

Overweight and obesity are defined differently for children and teens than for adults. Children are still growing and boys and girls mature at different rates. Body mass index (BMI) for children and teens compared their heights and weights against growth charts that take age and sex into account recognized as BMI-for-age percentile. A child or teen's BMI-for-age percentile shows how his or her BMI compares with other boys and girls of the same age (Peterson et al., 2016). Instead of set thresholds for underweight and overweight, the BMI percentile allows comparison with children of the same sex and age. A BMI that is less than the 5th percentile is considered underweight and above the 95th percentile is considered obese for people 20 and under. People under 20 with a BMI between the 85th and 95th percentile are considered to be overweight (Saito and Shimazaki, 2007).

## CALCULATIONS AND INTERPRETATION OF BODY MASS INDEX (BMI)

Body mass index (BMI) is calculated the same way for both adults and children. The calculation is based on the following formulae in Table 1.

## HEALTH CONSEQUENCES OF OBESITY ON GENERAL HEALTH

Overweight individuals are at increased risk for many diseases and health conditions including hypertension, dyslipidaemia (for example, high low-density lipoprotein

(LDL) cholesterol, low high-density lipoprotein (HDL) cholesterol, or, high levels of triglycerides), Type 2 diabetes mellitus (DM), coronary heart disease, stroke, gall bladder disease, osteoarthritis, sleep apnoea and respiratory problems and some cancers (especially, endometrial, breast and colon) (NHLBI, 1987). Moreover, obesity, also, has psychological, social and economic as well as oral health consequences. The only positive effect of obesity is a reduced risk of developing premenopausal breast cancer and osteoporosis in females. Obesity is a systemic disease that predisposes to a variety of co-morbidities and complications that not only affect the overall health but, also, influence oral health (en.wikipedia.org, 2011).

**Table 1.** Calculations and Interpretation of Body Mass Index (BMI).

Measurement Units	Formula and Calculation
Kilograms and meters (or, centimetres)	<p>Formula: <math>\text{weight (kg)} / [\text{height (m)}]^2</math></p> <p>With the metric system, the formula for BMI is weight in kilograms divided by height in meters squared. Since height is commonly measured in centimetres, divide height in centimetres by 100 to obtain height in meters.</p> <p>Example: Weight = 68 kg, Height = 165 cm (1.65 m)</p> <p>Calculation: <math>68 \div (1.65)^2 = 24.98</math></p>
Pounds and inches	<p>Formula: <math>\text{weight (lb)} / [\text{height (in)}]^2 \times 703</math></p> <p>Calculate BMI by dividing weight in pounds (lbs) by height in inches (in) squared and multiplying by a conversion factor of 703.</p> <p>Example: Weight = 150 lbs, Height = 5'5" (65")</p> <p>Calculation: <math>[150 \div (65)^2] \times 703 = 24.96</math></p>

## HEALTH CONSEQUENCES OF OBESITY ON ORAL HEALTH

The most common health consequences of obesity on oral health include obesity which is related to several aspects of oral health, such as caries, periodontitis and xerostomia. In addition, obesity may have implications for the dental treatment plan. Several recent studies suggest that periodontitis occurs more frequently in obese individuals than in subjects with normal body weight. The obese individuals exhibited significantly greater mean pocket depth and a higher percentage of sites exhibiting visible plaque. Obesity has emerged as a risk indicator of periodontal disease and studies have reported that individuals with periodontitis had higher blood pressure than individuals without periodontitis. Furthermore, many studies have reported that periodontitis is more prevalent in persons with diabetes and that individuals with periodontitis have abnormal lipid metabolism (Saito and Shimazaki, 2007).

Recently, obesity has emerged as one of the major risk indicators of periodontal disease and conversely, the remote effects of periodontal disease on various systemic

diseases have been proposed. Amongst the systemic health disorders, Type 2 diabetes mellitus (DM) and cardiovascular disease (CVD) are established obesity-related diseases. If obesity is a true risk factor for periodontal disease, the association between periodontal disease, obesity, and Type 2 DM or CVD must be very complex because each is a confounding factor for the other. In addition, several studies have suggested that periodontal disease affects both glucose and lipid metabolism which are, themselves, very important factors in the development of both Type 2 DM or CVD (Saito and Shimazaki, 2007). Children who are obese and overweight prefer sweet and fatty foods more frequently compared to children with normal weight. Hence, there is a higher prevalence of dental caries in overweight and obese children in both the primary and permanent teeth. Elevated BMI is associated with an increased incidence of permanent molar interproximal caries. Hormonal changes in obese patients may affect mineral metabolism. The metabolic changes caused by obesity that have an impact on bone growth, also, affect tooth eruption. Children with a high BMI had higher eruption rates (Saito and Shimazaki, 2007).

Again, there is a well-described connection between periodontal disease and diabetes with implications that the relationship may be bidirectional. Clearly, these associations should be the reasons for the dental profession to intervene in the rise of obesity. Insufficient sleep is another factor in obesity problem and screening for sleep habits could be part of a comprehensive dental assessment along with height, weight and blood pressure. The dental profession is in a unique position to identify and aid in the treatment of obstructive sleep apnoea (OSA), a condition associated with obesity and diabetes (Saito and Shimazaki, 2007).

The rise of obesity and Type 2 DM in children is of great concern and the dental profession can play a role in raising awareness of overweight status as well as obesity risk behaviours. There are various methods to measure body fat which include skinfold thickness measurements, underwater weighing, bioelectrical impedance, dual-energy x-ray absorptiometry (DEXA) scans and isotope dilution methods. However, these methods are not always readily available and they are either expensive or need highly trained personnel. Furthermore, many of these methods can be difficult to standardize across observers or, machines complicating comparisons across studies and time periods (CDC, 2009a,b). Obtaining BMI and BMI percentile measurements can be a feasible addition to the dental protocol as it is non-invasive and requires a small time commitment and minimal cost. Accepting the premise that weight status is associated with oral health, weight screening, obesity prevention and intervention in dental offices can be advocated as part of the comprehensive dental assessment and treatment (Hague and Touger-Decker, 2008).

Calculating BMI is one of the best methods for population assessment of overweight and obesity. The BMI or Quetelet Index (QI) is actually a proxy for human body fat based on an individual's weight and height. Because calculation requires only height and weight, it is inexpensive and easy to use for clinicians. It is a fairly reliable indicator of body fat for most adults. Numerous research studies have related BMI, especially the degree of overweight to an increased risk of developing various diseases as well as premature death. Given the tremendous increase in the prevalence of obesity, dental professionals should promote a healthy diet not only to prevent dental decay but, also, to reduce the risk of obesity. In future preventive programmes, the importance of nutrition should not only be emphasized with respect to general diseases but, also, with regard to carious lesions, periodontal diseases, oral cancers and various other oral diseases. Dental professionals should participate in multidisciplinary medical teams managing obese individuals. Obesity is a complex disease and its relationship to oral health has been realized in recent years and therefore, the purpose of the study was to undertake a systematic review of the relationship between BMI and oral health (Saito and Shimazaki, 2007).

## **CAUSES AND FACTORS ASSOCIATED WITH OBESITY**

Having multi-factorial causes, obesity is largely attributed to the systemic energy imbalance created by excessive caloric intake and inadequate levels of physical activity. Since the 1970s, diets have shifted toward processed foods and beverages. Furthermore, the advent of new technologies has allowed for markedly more sedentary lifestyles (Popkin et al., 2012). Some of the key factors associated with obesity risk include socio-economic factors, minority status, geographic location, access to education, cultural beliefs and genetic influences (Skelton et al., 2009; Popkin et al., 2012).

## **BURDEN OF DISEASE**

Obesity has both physical and psychological complications. Physiologically, it increases the risk of Type 2 diabetes mellitus (DM), sleep apnoea, orthopaedic complications, certain cancers, periodontal disease, high blood lipids, hypertension and other cardiovascular risk factors. (Freedman et al., 1999; Schiel et al., 2006) A recent study indicates that obesity may affect children from birth linking maternal obesity and diabetes with autism spectrum disorders and development delays (Krakowiak et al., 2012). Psychosocially, obesity may have a long-term negative impact leaving the patient vulnerable to the development of depression, anxiety, social isolation, discrimination, a lower quality of life (QoL) and stigmatism. It has, also, been associated with unemployment, absenteeism and the potential for lower wages in comparison with non-obese employees (Caliendo and Lee, 2013).

## **OBESITY, SEDATION AND OBSTRUCTIVE SLEEP APNOEA (OSA) IN CHILDREN**

The significant interest to paediatric dentists is that android obesity in which fat is distributed primarily intra-abdominally is highly linked to oxygen consumption, cardiovascular risk and left ventricular dysfunction and may complicate respiration during dental treatment, especially, under sedation. Obesity is a condition in which patients are considered to have chronic compromised systems which can contribute to major injuries during sedation. Pharmacokinetics in obese people may influence drug absorption, distribution, metabolism and excretion; sedation agents may require a longer time to affect due to the increased distribution in body fat, as also, after the instillation, the fat sequestered sedative slowly returns to the systemic circulation resulting in a longer elimination time and leading to untoward side effects due to prolonged sedation. Obstructive sleep apnoea (OSA) is associated with both obesity and

diabetes and a summary review of multiple studies suggests that weight loss can improve OSA with a positive effect on metabolic and cardiovascular risks (Baker and Yagiela, 2006; Yu and Berger 3rd, 2011). Amongst the patients attending a diabetes obesity clinic, 58% had OSA that was associated with worsening glycaemic control. Children are, also, affected by OSA (Pillai et al., 2011). Kohler et al. (2009) found that amongst adolescents, there was a 3.5-fold increase in OSA risk with each standard-deviation increase in BMI percentile. Studies have demonstrated a relationship between OSA, inflammation and insulin resistance in obese as well as non-obese children (Verhulst et al., 2007). Dental professionals can play an active role in identifying children and adults with possible OSA and referring them for assessment (Padmanabhan et al., 2010). Early detection, referral and coordinated care with patients' physicians can prevent additional consequences and improve quality of life (QoL) (Simmons and Clark, 2009).

### **BODY MASS INDEX (BMI) AND DENTAL CONSIDERATIONS**

Dental professionals may be confronted with several aspects of obesity. In the first place, the obese patient may be too big for the dental chair. Bodyweight in excess of 140 kg may exceed the weight limitation for motorized chair function. The obese patient may be unable to extend the neck fully limiting optimal patient positioning. Sometimes the patient has to be treated in a semi-upright position to prevent respiratory problems. A decreased oral opening and an excess tongue volume hinder visualization and make it difficult to locate landmarks for instilling local anaesthesia. To prevent postoperative airway problems, unilateral treatment is recommended. Obese patients frequently have hypertension and diabetes. Children's bodies react differently to medications with drug dosing being an important issue in obese children (Chacon et al., 2004).

### **BODY MASS INDEX (BMI) AND XEROSTOMIA**

The pharmacological treatment of obesity may have oral side effects. The obsolete appetite-suppressive drugs fenfluramine and dexfenfluramine inhibited salivary flow leading to xerostomia. Xerostomia affects speech and leads to rampant caries. Obese patients frequently have hypertension and diabetes. Also, anti-hypertensive drugs lead to oral side effects such as xerostomia, and lichenoid reactions, etc. to add a few. Diabetic patients show poor wound healing, parotitis, xerostomia, the increased sugar level in the gingival crevicular fluid which leads to periodontitis and loss of alveolar bone (Wynn, 1998).

### **BODY MASS INDEX (BMI) AND DENTAL TRAUMATIC INJURIES AND TOOTH FRACTURES**

Obese children have only enamel and enamel dentine fractures due to more indoor play. The main reported trauma caused by obese children was indoor play (38.7%) while the most frequently reported cause for non-obese children was outdoor play (Petti et al., 1997). Although the Brazilian study amongst 116, 12 years old children failed to find a statistically significant relationship between obesity and dental trauma (Soriano et al., 2004). Another study from the same country reported those children with a BMI greater than 23 kg/m<sup>2</sup>, 1.93 times more likely to have traumatic dental injuries than non-obese children (Nicolau et al., 2001). A Finnish survey at the age of 31 years, also, found that obesity was associated with a high prevalence of dental displacements and avulsions (Perheentupa et al., 2001).

### **THE ROLE FOR THE DENTAL PROFESSIONALS**

It has been demonstrated that specific repeated messages from multiple resources are more likely to promote behavioural change than single-source messages. Primary care physicians and paediatricians are well-equipped to address the obesity issue. The American Academy of Paediatrics recommends that health care providers should encourage healthy eating patterns and routine physical activity and discourage television and video time by providing families with education and anticipatory guidance. However, evidence suggests that busy providers do not adequately follow these recommendations (Krebs and Jacobson, 2003).

Several studies have found that the detection of obesity during routine medical appointments is low and time constraints limit how much a clinician is willing or, able to discuss with patients (O'Brien et al., 2004). Tools targeting specific behaviours may be helpful. Dental professionals are in a good position to be able to supplement and reinforce the information received in the medical setting as well as initiate the conversation. Tavares and Chomitz, also, developed and tested the feasibility of a dental-office-based tool for children targeting obesity risk behaviors (Tavares and Chomitz, 2009). The Healthy Weight Intervention based on the concepts of Motivational Interviewing was designed for children of all weights and requires approximately 10 minutes during the routine hygiene visit. Using standard, evidence-based recommendations for improving obesity risks, this preventive intervention does not require specialized training (Resnicow et al., 2006).

The dental team is in a unique and favourable position to offer healthy weight intervention and obesity prevention. Most healthy patients visit dental professionals more frequently than a physician on an annual basis. Children and adolescents, in particular,

follow the paradigm of annual medical and semi-annual dental visits potentially allowing for twice the annual frequency of any intervention. Additionally, it is already standard practice for dental professionals to promote dietary habits that avoid calorie and sugar-dense foods and beverages for caries prevention. They can easily expand their counselling to emphasize the implications of these dietary practices, in addition, to the positive effects of physical activity and other lifestyle changes on both oral and systemic health (Resnicow et al., 2006).

For patients with suspected weight issues, the dentist can work alongside paediatricians, family physicians and dieticians by providing referrals. Some dental settings, particularly, paediatric dental practices, already measure weight and height for other purposes, particularly, for calculating dosages for local and general anesthesia (Tseng et al., 2010). Obtaining BMI and BMI percentile measurements can be a feasible addition to the dental protocol as it is non-invasive and requires a small time commitment and minimal cost (Hague and Touger-Decker, 2008). Accepting the premise that weight status is associated with oral health, weight screening, obesity prevention and intervention in dental offices can be advocated as part of the comprehensive dental assessment and treatment (Hague and Touger-Decker, 2008). There are strong links between obesity and oral health, particularly, with respect to diabetes and periodontal disease. Decreasing obesity risks through diet and lifestyle changes can have a positive impact on oral as well as systemic health. It is important for the dental team to consider all the key domains of obesity risk behaviours such as physical activity, screen time, and meal patterns, not only the diet (Tavares and Chomitz, 2009).

## **OBESITY PREVENTION AND INTERVENTION IN DENTAL PRACTICE**

Periodontal disease and obesity are associated with inflammatory stress and increased production of pro-inflammatory cytokines. These associations should be the reasons for dental professionals to intervene in the rise of obesity. Insufficient sleep is another factor in the obesity problem and screening for sleep habits could be part of a comprehensive dental assessment along with height, weight and blood pressure. The dental profession is in a unique position to identify and aid in the treatment of obstructive sleep apnoea (OSA), a condition associated with obesity and diabetes. The rise of obesity and Type 2 diabetes mellitus (DM) in children is of great concern. Once again, the dental profession can play a role in raising awareness of overweight status as well as obesity risk behaviours. Ultimately, a health condition as prevalent and serious as obesity must be approached by a concerted and collaborative effort of many disciplines and organizations. The dental profession should include

itself in this collaboration using the tools and education opportunities available. Although the connection between oral health and obesity is critical to understand, it should not be the sole motivating factor for taking action.

An important study by Curran et al. (2010) found that more than 50% of the American Dental Association member dentists reported that they were interested in offering obesity-related services but fewer than 5% did so. Interestingly, more than 60% of the general and paediatric dentists noted increases in overweight patients and 43% of the general dentists reported diagnosing more gingival and periodontal problems in those patients. Eighty percent agreed that they would be more willing to address obesity if there was a definitive link with oral health. Curran et al. (2010) reported that the fear of offending patients or, appearing too judgmental was the most reported barrier to considering obesity interventions. Additional barriers were lack of training and knowledge, time constraints, lack of reimbursement and lack of coordinated services for a referral. A survey of North Carolina Hygienists found that 95% felt that they have a role in helping patients improve nutrition and 65% were confident in discussing obesity-related risks (Nainar, 2012). Focus groups with dental hygienists have confirmed their willingness and confidence to expand their roles to include obesity prevention and intervention (Tavares and Chomitz, 2009).

Paediatric dentists have led the way in advocating and supporting the role of the dental profession in obesity management. They were significantly more likely than general dentists to take a role in their patients' weight-related health care even without a connection with oral health (Tavares et al., 2011). Paediatric dentists report nutritional and healthy lifestyle information during residency and continuing education programs which may influence their confidence in broadening their scope of practice with their patients (Dewundara et al., 2011). Dental organizations have supported the role of the dental teams in participating in obesity prevention. The American Academy of Paediatric Dentistry has set the monitoring, prevention and management of childhood overweight as an important research agenda. Lamster and Eaves expressed the view that dental professionals should institute and monitor obesity intervention, not only for the purposes of oral health but for a desire to positively affect patients' general health (Lamster and Eaves, 2011).

## **RECOMMENDATIONS**

Body mass index (BMI) calculation should be included in the standard dental evaluation of any paediatric patient, as it can provide a screen for potential health complications of the growing child. Informing and educating the health care providers about the importance of healthful eating and physical activity. Educating the

health care providers to identify and reduce the barriers involving patients' lack of access to effective nutrition counselling and physical activity programs. An encouraging partnership between health care providers, schools, faith-based groups and other community organizations might, also, be useful in the prevention of obesity. Weight screening should be an integral part of periodontal risk assessment on a regular basis as it will reduce the patient's risk of developing chronic diseases including periodontitis. The dietary intervention to induce weight loss has often, also, the positive impact has on the level of periodontitis and caries. Therefore, dieticians and dental professionals should collaborate in the treatment of obese individuals. Future studies should address which factors specific to overweight in children might be protective against oral health conditions. Given the importance of being overweight as a public health concern, however, clinicians are encouraged to continue providing health education and dietary counselling to their overweight child patients.

## FUTURE DIRECTIONS

It is clear from surveys that education and exposure to systemic health interventions during training are key elements in encouraging the integration of these elements into clinical practice. Introducing systemic health screenings and prevention and intervention protocols in dental health education is a key element in widespread implementation. Finding methods to work within the constraints of the current practice modalities is important for feasibility. At the University of Toronto, Faculty of Dentistry, students are using a simplified identification of overweight status in children incorporated into a shortened version of the Healthy Weight Intervention to provide a 5-minute preventive intervention at each visit. Expanding beyond the dental clinic, it will, also, be important to include dental delivery settings in schools that service lower-income children at higher risk for obesity. Tavares and Chomitz recently completed a feasibility study of obesity intervention in several models of school-based dental care (Tavares and Chomitz, 2009). Of all the obesity-related systemic diseases, diabetes has the most impact on the management of oral health. Identifying early cases or, undiagnosed cases of Type 2 diabetes mellitus (DM) in the dental setting would be a great service to patients potentially affecting the rising incidence and costs of this disease. Tremblay et al. (2011) proposed a predictive model using dental parameters for the detection of undiagnosed diabetic individuals. Some dental sites, particularly, in the absence of consistent medical care, conduct finger stick blood glucose tests for their patients who are diabetic, irrespective of direct reimbursement. Although blood tests are feasible in the dental setting, ultimately, the use of saliva as an early diagnostic tool for diabetes or, its precursors would be a good fit for the dental profession.

## CONCLUSION

Dental professionals must be aware of the increasing numbers of obese patients and the significance of obesity as a multiple risk factor syndrome for oral and overall health. Dental professionals have a crucial role in the prevention and detection of many oral and systemic diseases because of their diagnostic and screening abilities as well as the frequency of patient visits. These invaluable skills and practice paradigms should be considered as part of the equation to solve one of the largest public health concerns of our time: the obesity epidemic. Currently, the United States and many other nations are in the midst of this epidemic and its resulting implications. Chronic diseases, particularly diabetes and cardiovascular disease, are the result of obesity. There is a well-described connection between periodontal disease and diabetes with implications that the relationship may be bi-directional.

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