Obesity and oral disease – a challenge for dentistry

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VERIFIABLE CPD PAPER

PRACTICE

IN BRIEF

- Provides an increased awareness of the significance of rising obesity and its impact on the provision of dental care.
- Highlights the grave concerns over rising childhood obesity and prevalence of obesity in the UK compared to other EU countries.
- Outlines the impact of obesity on systemic morbidity and oral disease, especially with regards to chronic periodontal disease.

The prevalence of overweight and obesity is rising in many developed and developing countries and, most worryingly, among children. Within the EU, Scotland has the highest prevalence, more than twice that of the Netherlands, and in England almost a quarter of children now enter primary school either overweight or obese, rising to one in three on leaving at age 11 years. Whilst most epidemiological data is based on body mass index, this is not a reliable indicator of individual adiposity and morbidity risk. The association between excess adiposity and type 2 diabetes is well recognised and the latter carries implications for oral disease and dental treatment. Current research has not established a clear association between excess adiposity and caries prevalence, however, there is evidence for a higher prevalence of chronic periodontal disease in obese populations. There is some evidence that this is not mediated solely by diabetes, but by secretion by adipose tissue of chemical mediators of inflammation, including cytokines and hormones, which could modify the response of the periodontal tissues to the oral environment. Dental professionals must become aware of this growing problem, of the demands that the rising obesity prevalence will place on dental care services and the need for bariatric dental facilities. Together, with service providers, dental professionals must prepare for the challenge ahead.

INTRODUCTION

Will the rising tide of obesity change the practice of dentistry? Yes!

There is now abundant evidence from many sources that the prevalence of obesity has steadily increased in most developed countries during the last two decades and the consensus of expert opinion is that it is likely to do so for the foreseeable future. In an apposite paper in this journal, Reilly *et al.*[1] raised the issue of obesity in relation to dentistry. The aim of this paper is to review the current state of the obesity epidemic and the evidence for an association with oral disease, concluding with an assessment of how obesity may affect the delivery of dental care in the future.

THE OBESITY EPIDEMIC

The prevalence of obesity has more than doubled in the last 25 years in the UK. The Health Survey for England (HSE) data shows that in 2010, 68% of adults (aged 16 or over) in England were overweight or obese, 24% being obese.[2] In 2007, analysis by the UK government's Foresight programme indicated that over half of the UK adult population could be clinically obese by 2050.[3] The economic implications are substantial. The direct costs to the UK National Health Service (NHS) directly attributable to overweight and obesity was projected by the Foresight programme to double to £10 billion per year by 2050, whilst the wider cost to society and business was estimated to reach £49.9 billion per year, both at 2007 values. These figures may well prove to be underestimates. Tackling the rise in obesity is a central part of the UK Department of Health's strategy for public health.[4]

One of the most disturbing aspects of this problem is the rise in childhood obesity, pointing to the problem facing the next generation. In 2004, the UK government set a target of halting the rise in childhood obesity by the year 2010 and it is enshrined in the Public Service Agreement, in local delivery plans and in local area agreements.[5] However, the 2010/11 UK data from the National Child Measurement Programme (NCMP) shows that 22% of five-year-olds and 33% of 11-year-olds in England are either overweight or obese.[6] These alarming figures are almost certainly an underestimate as some parents or their children had refused consent for the measuring programme and the view of some of the measuring teams was that the majority of the excluded children were obese (personal communication).

THE DISTRIBUTION OF OBESITY

While international comparisons are difficult because of variations in reporting dates, survey methods and cut-off points, it would appear that of the EU countries, Scotland has the highest prevalence with 26.6% of men and 28.1% of women being obese.[7] This compares with 10.4% and 10.1% respectively for the Netherlands. In England the prevalence in 2010 was 24% and the latest figure for Northern Ireland is 24% and for the Republic of Ireland 25%. The United States had the highest prevalence at 35.5% of adults, followed by Mexico at a reported 30%. While Korea and Japan appear to have almost static rates of less than 4%, available data for all other countries indicate a rising trend.[8]

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Data from most countries suggest that obesity is more prevalent among the lower socio-economic groups. There appears to be little difference between the sexes based on BMI, but data from the 2010 UK HSE indicates that increased waist circumference is more prevalent in women. Since the NICE guidelines[9] suggest that both BMI and waist circumference should be combined to indicate the risk of morbidity, a greater proportion of UK women than men may now be at risk, especially from diabetes and cardiovascular disease. While the incidence of obesity increases with age, the alarming increase in childhood obesity and the evidence that obese children become obese adults, presents a truly frightening prospect for the next generation.[10,11]

Within England the 2010/11 NCMP results showed that obesity prevalence varied by strategic health authority (SHA).[6] South Central SHA has the lowest obesity prevalence for both Reception (age 5/6 years of age) and Year 6 (age 11/12 years of age) at 8.1% and 16.5% respectively, while London SHA showed the highest obesity prevalence, 11.1% and 21.9% for each age group respectively. A strong positive relationship existed between deprivation and obesity prevalence for children in each age group. The obesity prevalence among Reception year children in areas in the least deprived decile was 6.9% compared with 12.1% among those living in areas in the most deprived decile, while for Year 6 children the corresponding figures were 13.8% and 23.7%.

MEASURING OBESITY

The most widely used definition for overweight and obesity is body mass index (BMI), calculated by dividing an individual's weight in kilograms by the square of their height in metres (kg/m^2). It should be noted, however, that this measure is an epidemiological tool, developed more than 150 years ago and is not a reliable indicator of an individual's morbidity risk, which is more appropriately assessed by combining other indicators of central adiposity such as waist circumference, waist to hip ratio, skin-fold thickness and specifically an accurate assessment of body fat percentage. This is most reliably done using dual energy X-ray absorptiometry (DXA). For adults, a BMI of 25 or above is defined as overweight and 30 or above as obese.

For children, there is no universally accepted BMI-based classification system. This is because for children and young people, BMI is not a static measurement, but varies from birth to adulthood and is different between boys and girls. Interpretation of BMI values in children and young people therefore depends on comparisons with population reference data, using cut-off points in the BMI distribution (BMI percentiles). In the UK, it has been common to use the 85th and 95th centiles from the 1990 UK growth charts[12] to define overweight and obesity at a population level and this definition is used in the NCMP and for published data on national trends. In 2011, the Royal College of Paediatrics and Child Health issued new growth charts[13] to closer align them with the WHO charts.[14] The USA and some other countries use the 2000 growth charts produced by the Centers for Disease Control and Prevention.[15] However in the UK, paediatricians have used the 91st and 98th centile for assessing individual children, which if used on a population basis would give lower rates of prevalence. The International Obesity Task Force (IOTF) has put forward an alternative classification using data collected from a sample of children from six countries. By using a statistical device the IOTF system identifies the childhood percentile in the dataset corresponding to a BMI of 25 or 30 (overweight or obese) at age 18 and makes the assumption that this percentile is the definition of overweight and obese tracking backwards to birth.[16] The argument for this approach is that it allows international comparisons of levels of obesity in children to be made and gives a smooth transition from children to 18-year-olds when classification will be co-incident with the adult definitions.

OBESITY AND SYSTEMIC DISEASE

Systemic medical conditions associated with an increase in body weight and specifically adiposity is now well recognised. They include type 2 (formerly called late onset) diabetes, cardio-vascular disease and osteoarthritis. Diabetes affects about 194 million people worldwide and is now one of the most common non-communicable diseases globally. It is the fourth or fifth leading cause of death in most developed countries and there is substantial evidence that it is endemic in many developing and newly industrialised nations. The link with many cancers is now well recognised. In the UK, a comprehensive study of one million women found that increasing BMI was associated with a significant increase in the risk of cancer for 10 out of 17 specific types examined.[17] For every ten unit increase in BMI the relative risk for endometrium cancer was 2.89 followed by 2.38 for adenocarcinoma of the oesophagus. Breast cancer, the most common cancer in women with an overall prevalence of 5.6%, carried a relative risk of 1.4 for postmenopausal women.

OBESITY AND ORAL DISEASE

The dental profession has long recognised the impact of systemic health problems, such as diabetes both on the development of dental disease and the provision of dental care.[18] However, with the rise of obesity within populations, the problems faced by the dental profession will soon become evident. These problems extend from the impact of obesity both directly on dental disease together with medical conditions influencing the development and treatment of dental disease, to the practicality of treating the obese in a conventional dental primary care setting.[1] Sadly, the speed of the obesity epidemic has been greater than the recognition of the impending crisis by healthcare services. Many hospitals in developed countries are now recognising the need for bariatric equipment such as beds, hoists, wheelchairs and commodes to take patients weighing in excess of 350 kg. The cost implications for such re-equipping alone will have a very serious impact on resources, as will the increased width of bariatric beds, reducing the bed capacity of some hospital wards by half. Standard dental chairs are commonly rated to take a 135 kg (297 lb) static load to meet ISO 6875 but may not be able to lift or recline at this loading. A bariatric dental chair rated at 454 kg (1000 lb) is now being installed in a limited number of primary care dental settings in the UK and in many other countries, but at a cost typically four times greater than a standard chair (Bariatric Limited – Shoreham by Sea , United Kingdom). In addition there is concern over the difficulty and risks of providing general anaesthesia and sedation for dental treatment of obese patients.[1]

CARIES

Tuomi[19] was one of the first to consider the relationship between caries and obesity, finding that in a group of 515 Finnish schoolchildren the combination of obesity and previous caries experience was a strong predictor of caries in permanent molars.

However, more recently a number of studies have looked for an association between caries risk and obesity and the results can best be described as inconclusive. Studies of adolescents in Brazil[20] and young children in the United States[21,22,23] found no association, while a Swedish study found a weak association in primary school children.[24] A study in Iowa found an association between caries and obesity in young children of low socioeconomic status.[25] While a study of a small group of French adolescents found a high level of caries experience in severely obese subjects,[26] a study of 12-year-old French children found no association between BMI and caries experience.[27] Two large-scale studies of German school children both found a highly significant correlation between BMI and caries experience.[28,29] A systematic review of obesity and caries by Kanterovitz *et al*. in 2006 concluded that only one study showed a high level of evidence for an association.[30] Whilst the results of these studies lack a clear direction, one possible explanation lies in the diverse nature of the populations studied and confounding factors such as dietary patterns and the use of fluoride agents. A second explanation lies in the use of differing BMI cut-offs and indeed the reliance on BMI as an indicator of adiposity. A recent Italian study found no association between BMI and caries experience in a sample of 6-12-year-olds, but a significant positive association when adiposity was measured using DXA.[31] If further research should establish a direct relationship between childhood obesity and caries, then a possible mechanism comes from evidence that stimulated salivary flow rates are lower in obese children.[32] The association between the diet of the obese and caries prevalence remains a fertile topic for investigation.

PERIODONTAL DISEASE

In contrast to caries, two literature reviews provide evidence for a higher prevalence of periodontal disease in overweight and obese groups.[33,34] Whilst this evidence gains support from recent studies from Korea,[35] Jordan[36] and Finland,[37] a recent four-year follow-up of 396 Finnish adults found no significant association between BMI and deepened periodontal pockets.[38] Chronic periodontal disease is most commonly seen in adults and analysis of results from the United States Third National Health and Nutrition Examination Survey (NHANES III) showed a significant correlation between body composition and periodontal disease for adults with weight-to-hip ratio being most significant, followed by BMI, free fat mass and subcutaneous fat.[39] Further analysis from the same data set showed that only in the 18 to 34 year age group, were measures of body fat predictors of periodontal disease while underweight (BMI <18.5) predicted decreased prevalence.[40] A third analysis from the NHANES III survey of 2,452 non-smokers showed that adolescents aged 17-21 years had a increased risk for periodontitis for each 1 kg/m^2 increase in body mass index and for each 1 cm increase in waist circumference.[41] More recently two studies have supported a direct relationship between BMI and periodontal disease in young people[42,43] and this is a grave concern. In a study of 706 Brazilian adults where 60% and 65% of males and females respectively were overweight or obese, obesity was significantly related to periodontitis in adult, non-smoker women, but not in men.[44]

Whilst it had been noted that long-term studies were lacking,[33] three have recently appeared. Two from the USA, one showing significant disease progression over 25 years in obese men[45] and the second, a very large study of 36,910 healthcare professionals showed a significant direct relationship, even among the non-diabetic and never-smoking over a period of up to 20 years.[46] A Japanese five-year follow-up of 3,590 subjects showed evidence of a dose-response association between BMI and periodontal disease.[47]

Despite indications that it is the predisposition to type 2 diabetes that links obesity to periodontal disease, the large USA longitudinal study[44] and a large Finnish survey of non-diabetic, non-smoking adults showing an association between BMI and periodontal pocket depth[38] suggest alternative explanations. Yet a physiological basis for a causal relationship between obesity and periodontitis remains to be confirmed. It is known that adipose tissue secretes chemical mediators of inflammation, including cytokines and hormones and it is possible that increased secretion of such mediators of inflammation could modify the response of the periodontal tissues to the oral environment.[48] There is evidence linking periodontal disease with metabolic disorder, an increasingly common loose association of abdominal obesity, abnormal fat metabolism, hypertension, insulin resistance, high plasma fibrinogen and elevated C-reactive protein.[49] This strengthens arguments that periodontal disease and certain obesity-related systemic illnesses are related, with abnormal fat metabolism possibly being an important factor.

CONCLUSION

It should be recognised that the evidence for associations between obesity and oral disease, largely based on cross-sectional prevalence data, does not establish direct causation, either of oral disease by obesity or conversely of obesity by oral disease.[33] What can be stated with some confidence is that obesity is one factor in a complex relationship between these conditions. Whilst this relationship requires further investigation, some conclusions can be drawn. Firstly that overweight and obesity among most world populations have risen during the last two decades and this change appears to be driven by factors that are unlikely to recede. The rise in childhood obesity is the gravest portent of the future. Secondly, that this trend may adversely affect the prevalence of dental disease and will affect the delivery of dental care in the future. Dental professionals and those in training today must become aware of this growing problem, of the demands that this will place on dental care services and the need for bariatric dental facilities and the training of special care dentists. Together, with service providers, dental professionals must prepare for the challenge ahead. In the UK and in many other countries this challenge will inevitably fall on the state.

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