Characteristics Of Oral Health In Early Onset Obesity

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Emmanuelle Noirrit-Esclassan
Mathieu Marty
Isabelle Bailleul-Forestier

Dental university, Paediatric Department, Toulouse France
3 Chemin des maraîchers 31400 Toulouse, France
Corresponding author: I. Bailleul-Forestier
Email: isabelle.bailleul-forestier@univ-tlse3.ftr

The origins, and metabolic and physical outcomes of early onset of obesity are largely described in previous chapters. This section focuses on the oral cavity of children who are overweight or obese. Epidemiological and case-control studies have determined orofacial features specific to children of this population. Orofacial specificities in overweight or obese children are of various types. They could correspond to orofacial growth variations, increased risk of dental injuries, caries susceptibility, erosion, and periodontal defects.

Orofacial specificities

Obese children have a normal to accelerated growth rate despite low growth hormone (GH) levels. Craniofacial growth and development are complex mechanisms regulated by interactions among genes, hormones, nutrients and epigenetic factors. They lead to the final craniofacial morphology. Patients with GH deficiency exhibit a smaller anterior and posterior cranial base, and small posterior facial and mandibular height [1]. In a Swedish craniofacial morphometric case-control study, obese adolescents showed increased mandibular length, prognathic jaws and a reduced upper anterior face height. Despite low GH levels, obese children have normal levels of insulin-like growth factor (IGF-1). Craniofacial growth may be more dependent on free circulating IGF-1 [2]. So obese subjects exhibit an increase of some craniofacial parameters.

In Iranian and US populations, children who were overweight or obese, after being adjusted for age and gender, showed accelerated dental development whereas they did not have accelerated skeletal maturation [3,4]. According to the BMI classification, Costacurta et al. observed no statistical differences for chronological, dental and skeletal age between normal weight and obese children. However when the Fat Mass % was taken into account (McCarthy classification) the skeletal-dental age always increased with respect to the chronological age [5]. For orthodontic treatment in overweight or obese children, determination of skeletal maturation and dental development is important and the specificities of the jaw growth should be considered. Additionally, an earlier onset of puberty has been reported in children with higher percentile[6]. The onset of puberty conditions the beginning of orthodontic treatment. So these findings may be of interest in orthodontic procedures. Young obese subjects may need a different orthodontic treatment plan in comparison to normal weight patients of the same age. However, no protocol currently exists for the orthodontic treatment process of overweight or obese children.

In children, obstructive sleep apnea syndrome (OSAS) belongs to a broad spectrum of respiratory disorders that occur during sleep, and includes primary snoring and upper airway resistance syndrome. OSAS occurs more frequently and may be more severe in children and adolescents who are overweight or obese compared with lean children. [7]. In obese adolescents, the enlargement of the upper airway soft tissue structures, the increased size of the pharyngeal lymphoid tissue, and dysfunctional breathing contribute to OSAS. These children exhibit mouth breathing, narrower maxilla, open bite and lateral posterior crossbite. Adenotonsillectomy should be considered as the first treatment option for OSAS in obese adolescents. But it does cure half of them [7]. However, obesity at the time of diagnosis is a major risk for persisting OSAS after treatment, regardless of the severity of initial disease [8]. Emerging dental treatment options, such as rapid maxillary expansion, oral appliances and osteogenesis distraction may soon serve as viable or adjunctive treatment alternatives to adenotonsillectomy. These treatments help to normalize the craniofacial and dentofacial morphology, and to modify tongue posture and the airway, thus leading to restoration of a normal trajectory of facial growth and development in children [9].

Dental injuries

An increase in body fatty mass reduces postural stability by moving the centre of gravity. Moreover, obese patients have a functional limitation of the articulations [10]. An increased prevalence of bone fractures is detected among obese patients, a tendency that could be linked with dental traumatisms [11,12].

Some cross-sectional studies have tried to clarify this relation, but various biases can influence the results (cf Table 1). The limits establishing obesity fluctuate, and obesity was measured at the time of the study but not at the time of the trauma [18]. The evaluation of dental traumatism was only visual (without any radiography or vitality test), so this risk was undervalued [16,18]. The variability of these features could explain the heterogeneity of the results. Correa-Faria and Petti (2015) carried out a meta-analysis starting from 17 studies, 13 of them concerning young adolescents (12 years old on average) [25]. They concluded that a link existed between overweight/obesity and dental traumatism, although the force of this association was less strong than for other risk factors, such as the incisor overjet. The risk of traumatism was increased by 22% if the patient was obese, whereas the risk was 131% in the presence of an incisive overjet [25]. As dental traumatisms have increased prevalence among obese patients (28.6% of traumatism compared with 25.5% in slim children, Correa-Faria and Petti's (2015) meta-analysis suggests a causal association (and not only a statistical association) between obesity and dental traumatism [24].

Prevention of dental traumatisms involves orthodontic interception of malocclusion and the subject wearing a mouth guard when practising sports. An additional reason for managing excess weight is to avoid such dental injuries.

Caries risk

Both obesity and dental caries are important health issues with multifactorial aspects. They have become increasingly prevalent challenges to public health. Factors affecting the onset of carious lesions include oral hygiene, diet composition and frequency, salivary immunoglobulins, bacterial load, fluoride intake and socioeconomic status [26]. Overweight, obesity and dental caries are concomitant in many population groups, probably because of the common confounding risk factors such as socioeconomic status, high sugar intake frequency, cariogenic diet, and sedentary life style. Even the notion that they have a cause–effect relationship should be viewed with caution.

A number of studies have linked consumption of sweetened beverages with increased energy intake, obesity [27] and dental decay [28]. Some studies in primary, mixed and permanent dentitions report an association between obesity and dental caries [29, 30]. However the data collected in cross-sectional US surveys (NHANES, Third National Health and Nutrition Examination Survey (NHANES III)) showed no evidence that overweight children were at increased risk for dental caries [31,32]. In 2006, Kantowics conducted a first systematic review (1984 to 2004) reporting that only one of seven cross-sectional studies with children showed an association between obesity and dental caries [33]. A newer systematic review and meta-analysis quantified the relationship between obesity and dental caries in children using a systematic approach and considering the literature over a longer period (1980 to 2010) [34]. Overall, a significant relationship between childhood obesity and dental caries (effect size = 0.104, $P = 0.049$) was found in the studies using standardized measures for assessing child

obesity such as BMI-for-age centiles (effect size = 0.189, 95% CI: 0.060–0.318, $P = 0.004$) or IOTF cut-offs (effect size = 0.104, 95% CI: 0.060–0.180, $P = 0.008$). These studies, using standard assessment of child obesity analyses by dentition type, showed a significant association between obesity and dental caries in permanent (effect size = 0.198, 95% CI: 0.046–0.350, $P = 0.011$) but not in primary dentitions. Evaluations between normal-weight and obese children in industrialized countries (IC) showed a significant relationship between obesity and caries (effect size = 0.122, CI = 0.047–0.197, $P = 0.001$) in contrast to those from non-industrialized countries (NIC) (effect size = 0.079, CI = −0.106 to 0.264, $P = 0.264$) [34]. Mixed results for the relationship between obesity and dental caries could be explained by the use of standardized or non-standardized BMI, different growth rates among children of similar age [35], or genetic susceptibility to decay [36].

Based on the concept that diet, and in particular sugar, contributes to the development of dental caries and overweight, dental personnel have been suggested to be one of the cornerstones in weight counselling [37].

Another increasing dental trouble, dental erosion, could be statistically observed in young subjects above the 98th percentile for BMI. Erosion was more severe with a larger area affected than in normal weight children [38]. Children with gastroesophageal reflux disease (GERD) are more likely to have erosion defects. Moreover in children and adolescent, obesity is related to increased odds of GERD [39]. So dental erosion should be carefully sought in overweight or obese children to set up preventive and aetiological treatment (fluoride).

Periodontal diseases in children and adolescents.

Gingivitis and periodontitis are the two major forms of periodontal diseases, which are defined as inflammatory diseases affecting the periodontium. According to the American Academy of Pediatric Dentistry, gingivitis is an inflammation of the gingiva that does not result in clinical attachment loss. Periodontitis is characterized by an inflammation of the gingiva and by loss of connective tissue attachment and alveolar bone [40]. Untreated, it may lead to tooth loss. The primary aetiology of both diseases is bacterial dental biofilm that adheres to the tooth surface. Clinically, it is characterized by gum inflammation with oedema, bright red or purple colour and bleeding on probing [41]. The prevalence of periodontal diseases in children is lower than in adult patients [42]. However, gingivitis in childhood is considered as a risk factor for attachment loss in adult life [43].

Statistical link between obesity and periodontal diseases among children and adolescents
An exhaustive review of this link in current databases found 10 clinical trials and meta-analysis fitting the aims. The results are summarized in Table 2. Most of the authors observed that obesity was linked to periodontal diseases. First of all, a higher Plaque Index was observed in obese adolescents, who had poorer toothbrushing habits than individuals of normal weight [45,50]. Clinically, a simple gum inflammation (gingivitis) was frequently found, but attachment loss was not [44; 45; 49; 50]. However, Cinar et al. and Modéer et al. found greater pocket depth in obese patients [52;53]. Only one study did not show a relationship between obesity and periodontal diseases but the clinical examination was unclear [47].

Despite the great heterogeneity in the clinical indicators used, and in the groups of patients, a statistical association could be found between obesity and clinical gum inflammation. Biological markers of periodontal diseases were also more commonly found in patients suffering from metabolic syndrome or obesity. However, no evidence could be found to link obesity and bone loss. Moreover,

as with normal-weight individuals, the periodontal risk factors increased with age, and the adolescents and young adults were more affected than young children [44, 45].

The exact effect of obesity on the periodontium is not clearly understood. The most common inflammation markers used to validate the presence of periodontitis are interleukin-1β (IL-β), interleukin-8 (IL-8) and tumour necrosis factor α (TNF-α). TNFα plays a significant role in the pathogenesis and development of periodontal diseases and is found in the crevicular fluid of patients suffering from periodontitis [55]. IL-8 is a neutrophil chemoattractant produced during the inflammatory process [56]. These factors were commonly found to be linked with obesity in the paediatric samples of two studies [48; 53]. Obesity contributes to a pro-inflammatory environment by producing pro-inflammatory cytokines. For Katz et al., such cytokines, associated with other local factors, may contribute to gum disease in children and adolescents [51]. Moreover, it has been proved that some chronic infections may contribute to obesity development [57]. Although a recent review demonstrates that factors such as lifestyle and type 2 diabetes may confound the linkage between periodontal disease and obesity [58], physicians facing an obese child or adolescent may refer him to a paediatric dentist for a specialized consultation.

Clinical implications for oral prevention and treatment of child or adolescent with early onset of obesity

For the dental practitioner, the clinical examination of an overweight child or adolescent should evaluate oral functions in order to detect possible mouth breathing, and cross or open bite leading to mastication deficiencies. Any orthodontic treatment plan should consider variations in facial growth and dental maturation in children or adolescents with early onset obesity.
This examination routinely includes a caries risk assessment and a community periodontal index [59]. In case of doubt, a complete examination, including periodontal charting and radiological status should be performed. Conversely, the medical follow up by a physician of a subject with early onset overweight or obesity should include a dental examination.

Tables

Table 1: Review of link between obesity and dental injuries among children and adolescents

Author (year)	Country	Population: N	Age	BMI	Obesity and dental trauma association
Petti (1997) [13]	Italy	938	6-11	> 97th percentile	Obesity significantly increased the risk of trauma: 1/3 for obese and 1/5 for non-obese children.
Nicolau (2001) [14]	Brazil	652	13	BMI > 85th percentile	Overweight children had 1.93 greater risk of dental trauma
Soriano (2009) [15]	Brazil	1046	12	> 97th percentile (NCHS reference table)	Obese patients underwent 1.84 times more trauma than non-obese but "obesity" factor was not linked with trauma risk
Artun (2009) [16]	Kuwait	1583	13-14	>30	No difference of risk between 3 BMI groups: >18.5, <18,5 and <30, >30
Damé-Teixeira (2013) [17]	Brazil	1528	12	BMI > 85th percentile	No significant relationship between obesity and trauma
Al-Bajjali (2014) [18]	Jordan	1015	12	BMI>24.2 boys, BMI>25.2 girls (Centre for Disease Control and Prevention)	No significant relationship between obesity and trauma
Basha (2015) [19]	India	764	13	Overweight: 20.3-24.9 boys, 22.7-26.8 girls Obese: >25 boys, >26.9 girls (criteria of Indian Association of Pediatrics)	Risk of suffering trauma 2.78 time higher in obese and overweight children
Tapias (2003) [20]	Spain	388	10	BMI > 85th percentile	No relation between overweight and dental traumatism
Vijaykumar (2013) [21]	India	858	10-12 (10.81+/_ 0.43)	BMI > 95th percentile (Centre for Disease Control and Prevention)	Significant association between trauma and overweight: 3.85 greater risk of trauma in overweight patients, of either sex
Goettems (2014) [22]	Brazil	1203	8-12	BMI > 85th percentile	1.2 more risk of dental trauma in obese and overweight subjects
Martins (2012) [23]	Brazil	590	7-14	BMI > 85th percentile	No statistical link in multi variable analysis

Table 2: Review of link between obesity and periodontal diseases among children and adolescents

Author, (year)	Study type	Patients / control	Obesity and periodontal disease association
Galkina IuV et al. 2015 [44]	Observational study	168 obese adolescents / no control	Yes
Markovic D et al. 2014 [45]	Cross-sectional study	442 patients aged 6-18 years	Yes, association with Gingival Index
Scorzetti L et al. 2013 [46]	Case control study	44 obese patients aged 7-13 years / 59 controls aged 8-10 years	Yes concerning the risk factors but not attachment loss
Nascimento GG et al. 2013 [47]	Cross-sectional study	419 obese patients aged 8-12 years / 792 controls aged 8-12 years	No correlation between obesity and gingivitis but obese boys have higher risk of gingivitis.
Kâ K et al. 2013 [48]	Cross-sectional study	175 obese patients, 25 of whom had metabolic syndrome aged 8-10 / 273 patients aged 8-10	Patients with metabolic syndrome show higher inflammation factor and gum bleeding, especially in boys.
Fadel HT et al. 2014 [49]	Case-control study	27 obese adolescents / 28 controls	Yes, more gingivitis but no increase in depth of periodontal pockets.
Franchini R et al. 2011 [50]	Case-control study	47 obese and 48 controls aged 10-17 years	Yes higher gingival index among obese patients.
Modéer T et al. 2011 [52]	Case-control study	52 obese adolescents/ 52 controls	Yes, more gum inflammation, more periodontal pockets, greater periodontal pocket depth**,** but no bone loss.
Cinar AB et al. 2011 [53]	Cross-sectional study	611 patients	Yes, more gum inflammation and greater pocket depth.
Reefes AF et al 2006 [54]	Case control study	111 adolescents aged 13-21 years with at least one periodontal pocket. 2341 controls.	An increased risk of periodontal disease is related to waist circumference and weight.

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~ About the Authors ~

Pr Isabelle Bailleul-Forestier, DDS, PhD, is a professor and head of the department of Pediatric Dentistry at Dental Faculty, Toulouse University, France.

The topic of her PhD was the expression of orodental signs of systemic and rare diseases. She is Visiting Professor, at the Centre of Human Genetics, Leuven, Belgium She contributes to clarify the relationship between obesity and dental caries in sever obese adolescents.

Dr Emmanuelle Noirrit-Esclassan, DDS, PhD is senior lecturer in the department of pediatric dentistry at Children's hospital in Toulouse, France. In clinics, she is taking care of children with severe early-childhood caries and special care children under sedation.

Dr Mathieu Marty, DDS, Msc, is an assistant professor in the department of paediatric dentistry at Toulouse University Hospital. He is involved in the paediatric oral mucosa pathology consultation.

His main research topic concerns pediatric periodontitis. Particularly, his work intends to develop diagnosis tools and periodontal treatment procedure for patient in medically underserved area with Pr J Palmieri (Blacksburg, USA).

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