Exploring the relationship between childhood adversity and oral health: An anecdotal approach and integrative view

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Introduction

In the Journal of Oral Microbiology, Editor-in-Chief Ingar Olsen addressed a solidly documented clustering of oral infections and systemic disorders [1]. Associated systemic conditions include cardiovascular disease, diabetes, low birth weight and preterm births, respiratory diseases, rheumatoid arthritis, obesity, osteoporosis, and, in particular among oral conditions, periodontal disease. Low-grade inflammation is a common denominator linking these disorders. Applying an anecdotal approach and an integrative view, the medical and dental histories of two women document increasing ill health subsequent to incidences of maltreatment and sexual abuse, including oral penetration, at an early age. Comprehensive oral rehabilitation was required in both cases. These cases open for medical insight with regard to their implicit pathophysiology, when integrated with current evidence from neuroscience, endocrinology, and immunology, converging in the concepts of allostatic and allostatic load. In cases such as those presented in this paper, primary care physicians (family doctors, General Practitioners) and dentists may be the first to identify an etiological pattern. This report underlines the importance of increased and enhanced multidisciplinary research cooperation among health professionals. Our hypothesis is that childhood adversity may affect all aspects of human health, including adult oral health.

Abstract

During the past two decades, increasing recognition has been given to a relationship between oral health and systemic diseases. Associated systemic conditions include cardiovascular disease, diabetes, low birth weight and preterm births, respiratory diseases, rheumatoid arthritis, obesity, osteoporosis, and, in particular among oral conditions, periodontal disease. Low-grade inflammation is a common denominator. Applying an anecdotal approach and an integrative view, the medical and dental histories of two women document increasing ill health subsequent to incidences of maltreatment and sexual abuse, including oral penetration, at an early age. Comprehensive oral rehabilitation was required in both cases. These cases open for medical insight with regard to their implicit pathophysiology, when integrated with current evidence from neuroscience, endocrinology, and immunology, converging in the concepts of allostatic and allostatic load. In cases such as those presented in this paper, primary care physicians (family doctors, General Practitioners) and dentists may be the first to identify an etiological pattern. This report underlines the importance of increased and enhanced multidisciplinary research cooperation among health professionals. Our hypothesis is that childhood adversity may affect all aspects of human health, including adult oral health.

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current knowledge to focus on the lived body, that is, on the impact that embodied lifetime experiences have on health [17,18].

The hypothesis

Homeostasis, allostatic, and allostatic load

Applying models of homeostasis, health is traditionally defined as a state in which all physiological parameters operate within a given norm [19]. A different definition emerges, however, if one’s point of departure is the dynamic concept of allostasis. A Greek word, ‘allostasis’ means ‘stability through change.’ Allostasis thus denotes the body’s adaptation to any given situation or context [20]. Allostatic load, as applied here, refers to the accumulated impact on the body of repeated allostatic responses to situations which are, or are perceived of as being, dangerous, that is, as being threatening to homeostasis [21]. These types of stressors trigger the release of catecholamines, in an interaction between the autonomous nervous system and the adrenocortex (SAM-axis). Simultaneously, the hypothalamus/pituitary gland/adrenocortex-axis (HAP-axis) is activated, resulting in a release of cortisol and other stress-related hormones [22]. The allostatic load model traces the sequence of how chronic overload on the SAM and HPA-axes engenders disease [23]. The chronic distress brought on by burdensome life experiences may, in turn, provoke complex illness and/or chronic disease. Distress of this kind may be inherent in such experiences as an unfair workload, unemployment, economic strain, loss of close relatives, breakdown of relationships, exposure to violence, torture or displacement as a result of war, and maltreatment, abuse or neglect during childhood. Such experiences trigger mental and physical processes which impact on the immune, hormonal and central nervous systems alike [24–31].

Allostatic load – a relevant topic for dentists?

As an example of a chronic, systemic illness, periodontitis is a multifaceted and tissue-destroying disease that is associated with genetic, immunological, and bacterial factors. Based on comprehensive research, periodontal disease may be seen as resulting from a disturbed interplay of the brain and neuro-hormones, compromising the immune system’s adaptive capacity to respond optimally to pathogenic oral bacteria [32]. Dentists, especially those treating children, disabled people and adults experiencing chronic oral or mandibular pain, have become increasingly aware that dental and orofacial pain are often indicators of wider health problems [33]. Chronic oral diseases may also be related to, or be the result of, maltreatment, abuse or neglect during childhood, adolescence or during adult life. [34,35]. Abuse and maltreatment can, in fact, impact all aspects of health [36], including oral health [37], as illustrated by the following case.

A woman whom we have named Judith Jansson was raped at 11 years of age by a male neighbor. Throughout the next year, the man provided his friends with frequent opportunities to abuse the girl through forced oral penetration. At the age of 12, she was admitted to a hospital suffering from severe abdominal pain, jaundice and pancreatitis. The surgeons concluded that the cause was a gall-stone and decided to perform a cholecystectomy. The patient did not relieve her abdominal pain, which continued unabated into adulthood. While still a teenager, the condition of her teeth deteriorated and she developed severe dental fear. Learning to swim became impossible and even showering could pose a threat as she was particularly afraid of water – or anything else – “running over my mouth.” At age 15, she attempted suicide and was admitted to a psychiatric unit. Also, she developed asthma and was diagnosed with anxiety disorder. Decades later, the woman came to understand that her “asthma” was triggered by the fear of being suffocated by having something big in her mouth. Her attacks of anxiety were always accompanied by nausea, which very often led to vomiting. While still a teenager, she developed serious eating disorders. Since she experienced that she could sometimes control both her nausea and her vomiting by eating, she soon became grossly overweight. Later, she also realized that she could actually control both her abdominal pain and her eating problems by avoiding all foods with a shape, color, smell, consistency or taste that reminded her of a penis or of semen. After such massive oral abuse, and given the effects which that had indelibly inscribed on her body, her self-perception demanded that she draw a distinct line between her and what she had been forced to endure. Beginning in early adulthood, she abused alcohol and, on several occasions, was involuntarily committed to a psychiatric unit. There, she was medicated with various psychotropic drugs and, once, tried to hang herself. Her bad teeth caused a variety of eating problems and much oral pain. The expense of innumerable dental interventions, including implants, forced her to go into debt. Now in her early sixties, she suffers from type-2 diabetes, hypertension, hyperlipemia, atopic eczema and arthritic pain. She has always dissociated when receiving medical or dental treatment. She has only recently found the courage to request of her doctors that they, “Talk to me so I can bear to be present.”.

Allostatic load – a shared topic for dentists, cardiologists and obstetricians?

The previous history exemplifies a much debated cluster of health problems, namely that of CVD and periodontal disease [14]. An earlier hypothesis of the direct transfer of oral bacteria to cardiac tissue has been invalidated. However, CVD and periodontal disease share the common denominator of systemic inflammation, which also links periodontal disease to preclampsia, a condition resulting in low birth weight and preterm births [38–41]. Documentation of an increased risk of preeclampsia among pregnant women suffering from periodontal disease has generated many studies measuring the outcome of dental treatment in relations to its impact on premature delivery, infants born alive, and low birth weight for gestational age. Researchers have concluded that, while it is safe to treat periodontitis during pregnancy, doing so does not contribute significantly to reducing the risk of low birth weight or preterm births. Michalowicz and colleagues’ findings [39] were supported by Offenbacher and colleagues in a review of all treatment studies of pregnant women with various oral diseases [41], as well as through another randomized controlled trial (RCT). As a result, Offenbacher’s team concluded: “These findings suggest that a single treatment employing only scaling and root planing was not adequate to control gingival inflammation between baseline and delivery. Preterm birth and periodontal disease may both share a common underlying condition or trait, for example, an exaggerated inflammatory response that might explain the clinical response to the oral infection and the inflammatory process associated with obstetric complications.”

Shortly afterwards, a team of gynecologists and dentists published a study which did not confirm periodontal disease as a risk factor for perinatal complications [42]. Then, in a follow-up, the same group demonstrated that pregnant women whose dental treatment had been successful had significantly fewer preterm deliveries than women who had not been treated successfully [43]. This result, however, was not substantiated in a review of

1 This case, part of the material of a doctoral thesis, has been explored and presented in a book (Kirkengen AL. Inscribed bodies. Springer; 2001) and has recently been updated by the women herself for this publication.
all studies concerning the relationship between treatment and all kinds of adverse pregnancy outcomes [44]. In a commenting editorial, Macones wrote: “The treatment of periodontal disease in pregnancy cannot be recommended. It might be time to re-examine some basic assumptions about the causes of adverse pregnancy outcomes and explore new mechanisms and treatments” [11]. Researchers in the field are now in agreement that periodontal disease, low birth weight and preeclampsia may share a common source: inflammation [40]. Meanwhile, there is increasing evidence that maternal health, birth outcomes, and fetal and child development are all associated with maternal distress, from prior to conception through pregnancy and the perinatal period [45–50].

**Allostatic load – a topic for all physicians?**

In cases where the inflammatory effect is of sufficient strength and duration, systemic manifestations of disease may appear [29,51]. Activation of the immune system accompanied by an increase in circulating cytokines leads to increased activity of the corticotropin releasing hormone (CRH), activating the HPA-axis and resulting in a rise in the level of cortisol. During an “acute emergency”, a high level of cortisol serves a lifesaving physiological function. However, in a “constant emergency”, in other words, when chronic distress results in consistently elevated levels of cortisol, the following occurs:

- blood pressure, heart rate and muscular tonus are persistently elevated;
- metabolism of lipids and glucose is persistently disrupted;
- bone tissue is depleted of its minerals;
- pain perception is aggravated and intensified;
- the risk of chronic inflammation rises due to chronic activation of the hormonal functions of the immune system;
- there is a rise in the risk of frequent infections in connection with all types of microbes, of prolonged infections, of reactivation of latent viral infections, of reduced antibiotic production, and of uncontrolled cellular proliferation, due to a chronically compromised response within the cellular components of the immune system, both the innate and the acquired [51–54].

Consequently, the risk of CVD, stroke, obesity, osteoporosis, chronic pain syndromes, and chronic systemic inflammations increases. Thus, in many chronic diseases, a positive association between the level of cortisol and the extent and degree of the disease may be observed. For example, cortisol in saliva, activated by the HAP-axis, has been found to associate positively with the extent and severity of periodontitis [55]. A population-based study showed a clear relationship between inflammatory markers and the diurnal cortisol curve as measured in saliva [56]. Numerous studies indicate that cortisol excretion in saliva is a reliable measure of the HPA-axis’ adaptability to stress [57]. The level of cortisol in saliva is often used now as a biomarker of stress and stress-related diseases. Since saliva samples are easy to obtain, this technology has even been utilized, with equivalent reliability, with three-year-old preschoolers [58].

In addition to the previously mentioned correlations between periodontal disease, low birth weight and preeclampsia, a significant correlation has been shown between preeclampsia and CVD [59,60]. Other adverse outcomes of pregnancy have also been shown to correlate with CVD [61]. In other words, we face a triangle of sickness that defies the classical medical conceptualization that these states are both distinguishable from one another and categorized differently as to etiology, treatment, and prognosis. The triangle, however, makes perfect sense if one applies a model in which allostatic load is attributed significance as a potential pathogenic force. Moreover, the triangle becomes a rectangle if one includes the documented dose–response relationship between metabolic syndrome and preterm birth [62]. Metabolic syndrome, a pattern of obesity, hypertension, hypercholesterolemia, and dysregulated blood glucose, carries an increased risk for both type-2 diabetes and CVD. There is evidence of a strong correlation between allostatic load and metabolic syndrome in both women and men [63–68]. Moreover, obesity, the primary indicator of metabolic syndrome, is strongly associated with experiences of abuse and maltreatment, reported from age three, during childhood and adolescence and into adulthood [69–77].

**Complex trauma – complex disorders**

The apparently separate diseases of periodontitis, CVD, preeclampsia, obesity, type-2 diabetes, and metabolic syndrome prove, in fact, to be related to other apparently separate diseases, all of which are considered to sort unambiguously into differing disease categories all of which are presumed to be separate and discrete. These include, among others, chronic obstructive pulmonary diseases (COPD), depression and auto-immune diseases. In addition, each of these, both singly and in their interrelationship, has now been discovered to be associated potentially with complex traumatic experience [12,13,24,26–28,31,36,37,52,54,78–81]. There is an increasing amount of solid evidence that experiencing complex trauma affects the body’s physiology measurably. As both the mind and the body are affected, the impact of adverse experiences can be seen to transcend the boundaries of the dualistic theory on which biomedicine is based (Fig. 1).

**Patterns of morbidity**

Most participants in a study focusing on women who provoked vomiting reported that their bulimic periods were precipitated by associations they had to forced oral penetration [82]. In a Norwegian study at a clinical department specializing in the treatment of people with eating disorders, 68% of the participants reported having experienced unwanted sexual contact [83]. Forced sexual contact has also been shown to disturb normal eating patterns in young people of different ages [74,84–87]. Bulimia correlates strongly to other kinds of health problems, particularly among young people [87], such as seizures, hypertension, chronic fatigue, chronic pain, asthma and other respiratory diseases, and suicide attempts. As mentioned previously, morbid obesity and adverse childhood experiences are correlated. Violated persons’ accounts bear witness to the reality that having one’s mouth alienated by force may impact on the activities of breathing, eating, speaking, tasting, savoring, kissing, opening up, taking in, and smiling; it may affect the physiology of breathing, food intake, speech, the voice, digestion and dental health; and, it may disturb a person’s emotional life, body perception and/or self-awareness. The following narrative illuminates the trajectories of such complex problems.

A woman, whose abuse by her stepfather from early childhood to late adolescence involved frequent, forced oral penetration, developed a strong aversion towards having “things” in her mouth, including toothbrushes, toothpaste and toothpicks. As a consequence, her teeth soon developed caries, necessitating frequent visits to the dentist. She recalls that her stepfather always insisted on accompanying her and remaining present during her dental treatments. Gradually, she realized that he intended to monitor what she was asked and what she answered. Her comment on this is as follows: “There was no risk I would expose him. Mainly, because I was never asked anything other than whether or not I brushed my teeth. Then, of course, I lied. But the real reason I couldn’t expose him was that, whenever I sat down in the dentist’s chair I simply ‘moved out’. I wasn’t really there. I still used that
All these associations can be explained in terms of chronic pregnancy is predictive of all types of obstetrical complications presented text.

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incidence of sexually transmitted diseases, teenage pregnancies unprotected sex, a greater number of sexual partners, an increased proved to be at increased risk of having an early sexual debut,

... and in every situation similar enough to reactivate the abuse experiences: at the dentist, during gynecological examinations and in numerous other situations.

In young adulthood, jaw spasms seriously hampered both her speaking and her eating. She simply could not open her mouth wider than a finger's width. She was instructed by her dentist to pry her mouth open by forcing her fingers between her teeth. She experienced such a forced self-invasion as a reenactment of the forced invasions to which she had been subjected. This medically imposed "exercise" caused her great distress and resulted in a severe depression. She was provided with a rubber mouth guard to place between her teeth to prevent her spasmodic tooth grinding from damaging her teeth. As one might expect, the feel, taste and texture of the mouth guard reactivated sensory memories of the oral abuse; eventually, this treatment was abandoned. The woman reports being in continuing and lifelong need of extensive and expensive dental treatment. She also requires regular assis-

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tact. I know that I'm here in this chair, but in my reality, I'm still sitting in the waiting room – that way, I can bear what's being done in my mouth. The result is that I never know what the dentist has been telling me, which means I have to go back days later to find out what has been done." To dissociate in order to being able to endure what feels unendurable was the only option this woman felt she had to protect or shield herself, both during the abuse and in every situation similar enough to reactivate the abuse experiences: at the dentist, during gynecological examinations and in numerous other situations.

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Implications

Girls growing up in abusive, violent and chaotic families, have proved to be at increased risk of having an early sexual debut, unprotected sex, a greater number of sexual partners, an increased incidence of sexually transmitted diseases, teenage pregnancies and unwanted pregnancies. These, in turn, are identified as independent risk factors for complications during pregnancy, including preterm birth and preeclampsia [48]. A violation experience during pregnancy is predictive of all types of obstetrical complications [46]. All these associations can be explained in terms of chronic activation of the HPA-axis resulting in inflammatory responses, in increased receptivity to infection, including oral infections, and in increased vulnerability to having otherwise minor infections become severe and protracted. Pediatrician Thomas Boyce and colleagues studying 5-year old children have demonstrated how psychosocial, infectious, and stress-related processes seem to converge in the development of caries and thus contribute to increasing the risk that future, overall dental health be impaired [13]. The highly acknowledged, prospective Dunedin Study from New Zealand, which followed the impact of psychosocial distress on children over a period of years, has shown a clear correlation between the dental health of the children and that of their parents, reflecting social gradients [88]. In a recent US study, allostatic load, impaired dental health, and low sociocultural status have also been shown to be associated [12].

Research in a range of fields including psychology, neurology, immunology and endocrinology along with neuroradiology, genetics and epigenetics, has been exploring the relationships between allostatic load and chronic pain syndromes. The researchers refer to “overlapping pains” because these pain syndromes cross anatomical, neurological, functional as well as systemic boundaries. In doing so, these “pains” blur the boundaries delineating the biomedical system of specialties [89]. In 45–90% of the cases, these ostensibly different syndromes actually formed complex patterns of “overlapping disorders”, closely linking, for example, stomach pain with pain in the pelvis, the bladder, the mouth, the mandibular joint, the face, the head, the muscles, the joints, and connecting all these pains to the incapacitating state of being that is presently termed, Chronic Fatigue Syndrome/Myalgic Encephalomyelitis (CFS/ME) [90]. In addition, a strong correlation has been found between “overlapping pains” and adverse experiences in general, and adverse childhood experiences in particular [16,91] (Fig. 2).

Future perspectives

There is growing evidence for strong trajectories leading from childhood adversity to adult morbidity, and to premature mortality. People suffering from chronic overload are in danger of developing patterns of chronic diseases characterized by inflammation, infection, and invasion in the sense of the development of tumors, as well as by chronic pain, anxiety and a sense of powerlessness.

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2 This case, too, is presented in Kirkengen AL. Inscribed bodies. This woman has also updated her treatment history recently and consented to have it published in the present text.
Primary care physicians (family doctors/General Practitioners) and dentists may be the first to recognize and acknowledge these patterns and thus, perhaps, uniquely positioned to be able to identify the source of the person’s overload. Caries and periodontal disease, hypertension and obesity may be signs, indices, markers, of something else and something more. Moreover, the documentation of the deleterious and destructive impact of chronic overload on health renders this issue relevant not only for dentists and GP’s but also for many other medical specialists. It is relevant above all, for pediatricians, gynecologists, obstetricians, cardiologists, endocrinologists, and specialists within infectious medicine, immunology and microbiology. This underlines the importance of developing coordinated perspectives for increased and enhanced multidisciplinary cooperation among all health researchers in the future, particularly in our everyday practices where all of us who are clinicians seek to help our patients. We conclude, therefore, that there seems to be an urgent need to focus on preventive efforts to reduce the incidence of child maltreatment, and that medical specialists in all disciplines, including dentistry, are called upon to contribute to this effort.

Consent

Written informed consent for publication was obtained from the two persons whose histories are cited in this paper. A copy of the written consent is available for the editor of this journal.

Authors’ contribution

A.L.K. and H.L. collected and reviewed the relevant literature and drafted the manuscript in close collaboration. H.L. designed the figures. A.L.K. provided the case histories in cooperation with the persons concerned. A.L.K. and H.L. read and approved the final manuscript.

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Conflict of interest statement

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