

**Stress: Mechanisms and Its Oral Implications**

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Abstract

Stress is the body's response to any physical, mental or emotional demand placed on it. It is automatic process and also known as the "fight-or-flight-or-freeze" reaction, or the stress response. Stress is the way human beings react both physically and mentally to changes, events, and situations in their lives. Modern day's life is full of hassles, frustrations, and demands therefore stress is experiencing by almost every individual at some point in life. This article reviews about mechanism of stress and its association with oral health of an individual.

Keywords: aphthous ulcer, lichen planus, oral lesions, stress.

1. Introduction:

The term stress originates from physical science where it refers to the force placed upon an object to cause straining, bending, or breaking. In the human context and in psychology, however, stress is often used to describe the body's responses to demands placed upon it, whether these demands are favorable or unfavorable and are in the form of life stress, organizational stress, and environment stress.¹

Stress is the body's response to any physical, mental or emotional demand placed on it.¹ It is automatic process and also known as the "fight-or-flight-or-freeze" reaction, or the stress response. Human body undergoes a series of chemical events during stress which affect

various organs to make us ready for bearing these unpleasant stimuli.²

Based on intensity of stimulus; stress can be categorized as mild, moderate and excessive stress. Mild stress may result in boredom; whereas moderate stress may actually improve your performance and efficiency by keeping you stay focused, energetic, and alert. Excessive stress stops being helpful and starts causing major damage to health, mood, productivity, relationships, and quality of life.³

Stress reactions are the emotional and physical wear and tear on the mind and body resulting from coping with life's problems and events.⁴ In human body every organ is affected by one or the other types of diseases like infectious, immunological, metabolic, endocrinal disturbances etc., based on etiology, pathogenesis, signs and symptoms diseases are diagnosed and managed at any early stage, still some diseases are considered as idiopathic. Stress is considered to be one such etiological or a predisposing factor in many diseases. Many studies have proved stress as an etiological or a predisposing factor to hypertension, gastric ulcer and diabetes mellitus.⁵

2. Symptoms

Symptoms associated with stress include 1.Cognitive symptoms (memory problems, inability to concentrate, poor judgment, seeing only the negative, anxious or racing thoughts, constant worrying); 2.Emotional symptoms (moodiness, irritability or short temper, agitation, inability

to relax, feeling overwhelmed, sense of loneliness and isolation, depression or general unhappiness); 3. Physical symptoms (aches and pains, diarrhea or constipation, nausea, dizziness, chest pain, rapid heartbeat, loss of sex drive, frequent colds); 4. Behavioral symptoms (eating more or less, sleeping too much or too little, isolating yourself from others, procrastinating or neglecting responsibilities, using alcohol, cigarettes, or drugs to relax, nervous habits like nail biting etc).⁶

3. Pathogenesis:

In fact, stress phenomenon had been identified 10 years earlier by a Harvard University physiologist, Walter Cannon, as the “fight or flight response”.⁷ Cannon theorized that mammals have a physical ability to react to stress that evolved as a survival mechanism. When faced with stressful situations, our bodies release hormones - epinephrine (adrenaline) and norepinephrine (noradrenaline) – that elevate the heart rate and increase blood flow to the muscles, gearing our bodies either to do battle with an opponent or to flee.¹

These responses include:

1. Rapid mobilization of energy from storage. Glucose, simple proteins and fats pour out of fat cells, liver, and muscles.⁸
2. Increased heart rate, blood pressure, and breathing to speed up the transport of nutrients and oxygen.
3. Inhibited growth and decreased sex drive. Females are less likely to ovulate or to carry pregnancies to term; males secrete less testosterone and have trouble with erections.⁹
4. Halted digestion. The large intestine is stimulated to release previously digested food to reduce bodyweight.
5. Inhibited immunity to save the body’s energy for the crisis at hand.
6. Diminished perception of pain.

7. Improved cognitive and sensory skills. Memory improves, except in the case of prolonged or extreme stress.

All of these responses are meant to be short-term in order to mobilize the body for action. They are shortsighted and inefficient, but they are important in a physical crisis situation.¹⁰

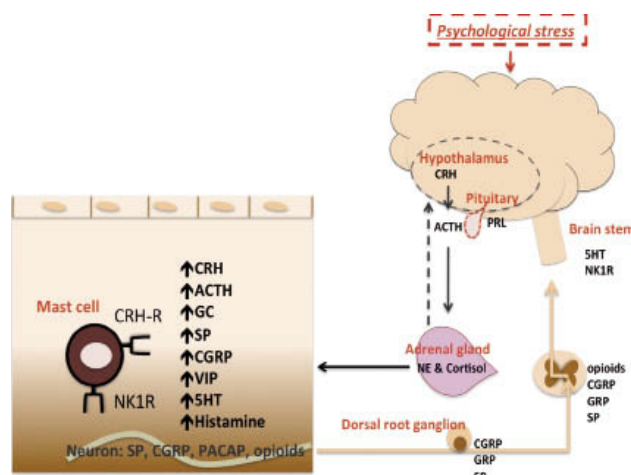


Figure 1: mechanism of stress development

4. Hormones of the Stress Response

The autonomic nervous system controls bodily functions which we are largely unaware of and do not consciously control. The part of the autonomic nervous system that is activated during emergencies is the sympathetic nervous system, which speeds up systems needed for survival.¹⁰ When something stressful happens or you think a stressful thought, many hormones are released by the brain, nervous system, and other organs:

- The base of the brain, the hypothalamus, secretes an array of hormones into the blood, mainly corticotropin releasing factor, which triggers the pituitary to release the hormone corticotrophin (ACTH).⁷ ACTH in the bloodstream triggers the release of glucocorticoids by the adrenal gland.

- The sympathetic nervous system releases epinephrine (adrenaline), and norepinephrine (noradrenaline) into the bloodstream.

- The pancreas releases a hormone called glucagon, which raises the circulating levels of glucose in the blood.
- The pituitary releases prolactin, suppressing reproductive systems and vasopressin, the anti-diuretic hormone.
- Both the brain and the pituitary release morphine-like substances called endorphins and enkephalins which limit pain perception. Epinephrine and glucocorticoids appear to act in similar ways, however epinephrine acts within seconds, while glucocorticoids are slower-acting, backing up the epinephrine for minutes or hours.¹⁰

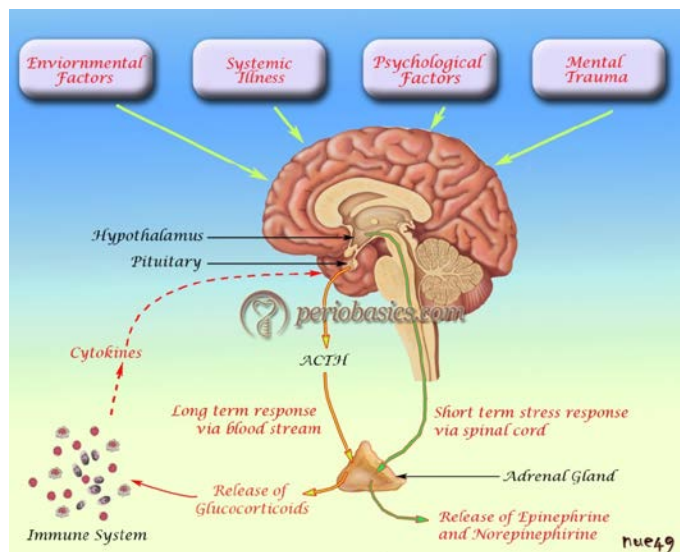


Figure 2: hormones released in stress

Together, epinephrine, norepinephrine, and the glucocorticoids account for a large portion of what happens in the body during stress.⁷ At the same time, the secretions of the reproductive hormones (estrogen, progesterone, and testosterone) and the growth hormones are inhibited during stress to conserve energy for the imminent fight or flight. The secretion of insulin is also inhibited, which normally tells the body to store energy. ⁷ The oral cavity is a region interconnected with other systems of the body; it should not be viewed as an isolated area. Diseases that it lays down can have systemic scope and significantly affect the quality of life of individuals who suffer them.¹¹ 5. Stress related oral conditions Gingivitis/periodontitis It is defined as an inflammatory

disease of supporting tissues (gums/periodontal ligament/alveolar bone) of teeth. Etiology could be hormonal changes in body during stressful period or poor oral hygiene maintenance due to distraction from overload of work or reduced efficiency in normal activities. [11]

The biological mechanism emphasizes how stress and depression can reduce immune system function and facilitate chronic inflammation. These effects are mediated through the hypothalamic-pituitary-adrenal axis and the production of cortisol, a glucocorticoid capable of reducing immunocompetence by inhibiting immunoglobulin A and G and neutrophil function, which leads to increased biofilm colonization and reduced ability to prevent connective tissue invasion.[3]

Additionally, after periods of chronic elevation, cortisol loses its ability to inhibit inflammatory responses initiated by immune reactions, which leads to sustained inflammatory destruction within the periodontium.[12] The behavioural mechanism emphasizes that people suffering from stress and depression may increase poor health behaviours, such as smoking or drinking more frequently, consuming an unhealthy diet and neglecting their oral hygiene. This leads to increased oral biofilm burden and decreased resistance of the periodontium to inflammatory breakdown.²

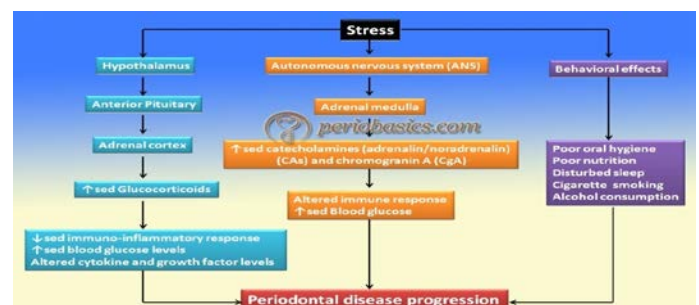


Figure 3: periodontitis association with stress
Dental caries/dental attrition/dental erosion

Poor oral hygiene maintenance can lead to dental caries where as parafunctional habits like nail biting/pen or pencil chewing etc can lead to dental attrition. Psychological stress also leads to indigestion or eating problems and such individuals often complain of vomiting or regurgitation which causes dental erosion on chronic exposure. [13]

Clenching

Clenching is tight closure of jaws together. It happens during day time when individual is working under stress and leads to muscle fatigue and finally spasm.¹⁴ It is unconscious act so individual often remain asymptomatic but after a span of time muscles of mastication especially temporalis and masseter muscles develop hypertrophy. [15] Studies have reported that people facing stressful life situations frequently develop tension-relieving mechanism. Thus oral clenching habits may serve a useful function psychologically to relieve tension.[16] Voluntary clenching of the teeth is a common maneuver used to facilitate peripheral monosynaptic reflexes and motor system excitability. It has also been indicated that an aggressive biting is associated with a significant attenuation of the stress-induced increase of nor-adrenalin turnover in the brain. Therefore, occlusion of the masticatory organ contributes significantly to an individual's ability to manage stress.

Bruxism

It is excessive grinding of the teeth. There are two main types of bruxism; one which occurs during sleep (sleep bruxism) and other which occurs during wakefulness (awake bruxism). Dental damage may be similar in both types, but the symptoms of sleep bruxism tend to be worst on waking and improve during the course of the day, whereas the symptoms of awake bruxism may not be present at all on waking, and then worsen over the day.[17]

The dental examination shows mild to severe attrition of the occlusal surfaces of the teeth. Symptoms are

hypersensitive teeth, aching jaw muscles, and headaches. Bruxism may even cause damage or breakage of teeth and dental restorations such as crowns and fillings. Sleep disturbances and behavioral/psychiatric disorders are among etiological factors. This condition can be managed by stress control programme, removal of occlusal interferences wearing night guard/occlusal splints or restoring vertical dimension of occlusion. [15]

Variables such as general stress, work-related stress, and personality traits have been increasingly considered as initiating, predisposing, and perpetuating factors for bruxism. Bruxism can cause pain and irreversible damage to the teeth, periodontium, masticatory muscles, and temporo mandibular joint.¹⁸

Myofascial pain dysfunction syndrome (MPDS)

It is also called as myofascial pain (non-dental origin) and is one of the most common temporomandibular disorders. Its etiology is multifactorial. Psychological factors have been shown as major etiology. [19] Schwartz was the first to implicate the psychological make-up of the patient as a predisposing factor. He hypothesized that stress was a significant cause for clenching and grinding habits, resulting in spasm of the muscles of mastication. Occlusal abnormalities play a secondary role in the etiology of the pain syndrome. [20] The signs and symptoms of MPDS are unilateral dull pain in the ear or preauricular region that commonly worsens on awakening, tenderness of one or more muscle of mastication on palpation and Limitation or deviation of the mandible on opening. Laskin Psychophysiologic theory states that MPDS is primarily a result of emotional rather than occlusal and mechanical factors. [21, 22]

Lichen planus

It is an immunologically mediated mucocutaneous disorder which often affects oral mucosa. Erasmus Wilson was the first person to describe it in 1869[12]. Oral lesions can present typical radiating white striae (wickam striae) and erythematous atrophic mucosa at the periphery of

well-demarcated ulceration.⁶ It is autoimmune condition with psychological stress as a major risk factor. Symptomatic treatment can be provided by topical analgesics or antihistamine rinses or more specifically by use of topical steroids. [24]

Recurrent oral ulcerations (aphthous ulcers)

It is a common disease of oral mucosa characterized by the appearance of one or more painful ulcers which heal and re-occur after a few days or weeks. The etiology of these ulcers is not clearly understood but emotional stress/immune responses are involved in the pathogenesis of these recurrent ulcers and Iron, vitamin B 12, folic acid deficiency are considered as predisposing factors. Antibiotic (especially Tetracycline) mouthwash, topical steroid or topical antiseptic gel and multivitamin tablets can be used for treating these aphthous ulcers. [25]

Burning mouth syndrome:

It is associated with burning sensation of tongue, lips and oral mucosa. This condition is often associated with sleep disturbances and behavioral/psychiatric disorders. It can be controlled symptomatically with topical anesthetic gel [mucopain gel-5% Xylocaine] along with topical antihistamine application [5% diphenhydramine hydrochloride] [26].

4. Conclusion

This Research study thus emphasizes the need to consider the role of stress in these oral lesions namely OLP, Aphthous ulcers, BMS and MPDS. If the clinical subjects are positive for stress, they must be referred to psychological counseling and anti-anxiety management.

5. Reference

[1]. Da Silva AM, Oakley DA, Hemmings KW, Newman HN, Watkins S. Psychosocial factors and tooth wear with a significant component of attrition. Eur J Prosthodont Restor Dent 1997; 5(2): 51-5.

[2]. Minneman MA, Cobb C, Soriano F, Burns S, Schuchman L., "Relationships of personality traits and stress to gingival status or soft-tissue oral pathology: an exploratory study." J Public health Dent, 1995; 55(1):22-7.

[3]. Rajiv Saini, Santosh Saini, and Sugandha R. Saini, "Periodontitis and psychological stress: A dental view," Industrial Psychiatry Journal. Jan-Jun 2010; 19(1)66.

[4]. Dr Bhushan K, Dr Prabhdeep K Sandhu, Dr Shaiba Sandhu PSYCHOLOGICAL STRESS RELATED ORAL HEALTH PROBLEMS- DENTAL PERSPECTIVE; IJRID Volume 4 Issue 3 May.-June. 2014

[5]. T.N.Uma Maheswari and N.Gnanasundaram, stress related oral diseases- a research study; international journal of pharma and bio sciences, 2010; 1(3):1-10.

[6]. Marcenes WS, Sheiham A. "The relationship between work stress and oral health status." Soc Sci Med. 1992 Dec;35(12):1511-20.

[7]. Makino M, Masaki C, Tomoeda K, Kharouf E, Nakamoto T, Hosokawa R., "The relationship between sleep bruxism behavior and salivary stress biomarker level." Int J Prosthodont. 2009 Jan-Feb;22(1):43-8.

[8]. Travell J. "Temporomandibular joint pain referred from muscles of head and neck." J Prosthet Dent, 1960; 10:745.

[9]. Schwartz LL. "Pain Associated with the temporomandibular joint." J Am Dent Assoc, 1955;51:394.

[10]. David S Evaskus and Daniel M Laskin, "A Biochemical measure of stress in patients with MPDS," J Dent Res, 51(5):1464-1466, (1972).

[11]. Gowri, P., Biju, T., & Suchetha, K. (2008). The challenge of antioxidants to free radicals in periodontitis., Journal Indian Society Periodontology, 12(3), 79-83.

- [12]. Glassman AH, Miller GE. Where there is depression, there is inflammation... sometimes! *Biol Psychiatry* 2007; 62(4):280–1.
- [13]. Irwin M, Patterson T, Smith TL, Caldwell C, Brown SA, Gillin JC, and others. Reduction of immune function in life stress and depression. *Biol Psychiatry* 1990; 27(1):22–30.
- [14]. Anthony M. Iacopino, Relationship Between Stress, Depression and Periodontal Disease; *JCDA*, 2009; 7(5).
- [15]. Daniela miricescu, Maria greabu, Alexandra totan, Maria mohora, Andreea didilescu, Niculina mitrea, Andreea arsene, Tudor spinu, Cosmin totan, Radu rădulescu, oxidative stress - a possible link between systemic and oral diseases; 2011, vol. 59, issue-3
- [16]. Wg Cdr SK Kaushik, Gp Capt R Madan, Wg Cdr A Gambhir, Sqn Ldr T Prasanth, Aviation stress and dental attrition; *Ind J Aerospace Med*, 2009; 53(1).
- [17]. Seligman DA, Pullinger AG, Solberg WK The prevalence of dental attrition and its association with factors of age, gender, occlusion, and TMJ symptomatology. *Journal of Dental Research* 1996; 67: 1323-33.
- [18]. Laskin D M. “Etiology of the pain dysfunction syndrome.” *J Am Dent Assoc*, 1969; 79:147.
- [19]. Neville B W, Damm D D, Allen C M, Bouquot J E. “Relation of stress and anxiety to Oral Lichen planus.” *Oral Surg Oral Med Oral Pathol*, 1986; 61:44.
- [20]. Boudarene M, Legros JJ, Timsit-Berthier M. Study of the stress response: Role of anxiety, cortisol and DHEAs. *Encephale* 2002; 28(2):139-46.
- [21]. Atessa Pakfetrat. “Oral Lichen planus:A retrospective study of 420 Iranian patients.” *Med Oral Patol Oral Cir Buccal*, 2009; 14(7): E 315-318.
- [22]. Ravindranath Vineetha, Keerthilatha-M. Pai, Manoj Vengal, Kodyalamoole Gopalakrishna, Dinesh Narayanakurup, Usefulness of salivary alpha amylase as a biomarker of chronic stress and stress related oral mucosal changes – a pilot study; *J Clin Exp Dent*. 2014;6(2)
- [23]. Tripathi K D., “Drugs used in mental illness In: *Essentials of Medical Pharmacology.*”, 3rd Edn. Jaypee Brothers Medical Publishers, (1994, p.371).
- [24]. Mc Cartan B., “Psychological factors associated with OLP,” *J Oral Pathol Med*, 1995; 24:273, ().
- [25]. L Preeti, KT Magesh, K Rajkumar, and Raghavendhar Karthik, “Recurrent Aphthous Stomatitis” *J Oral Maxillofac Pthol*. 2011;15(3):252-256..
- [26]. Brightman V J. “Oral symptoms without apparent physical abnormality In: *Burket’s Oral Medicine Diagnosis and Treatment,*” 9th Ed. J.P.Lippincott Company, Philadelphia, 1994, pp.369-399.