Sri Aurobindo College of Dentistry

Indore, Madhya Pradesh

INDIA

Module plan

- Topic :STRESS AND PERIODONTIUM
- Subject: Periodontics
- Target Group: Undergraduate Dentistry
- Mode: Powerpoint – Webinar
- Platform: Institutional LMS
- Presenter:Dr Kanteshwari IK

CONTENTS

- **Mechanism of action of**
- **psychosomatic factors**
-
- **Stress and wound healing**

- **Management of Stress**
-
- **Conclusion**

- **References**

Introduction

•***Stress*** *has been defined as the psychophysiological response of an organism to perceived threat or challenge* **[Breivik T et al 1996]**.

•*It is a state of physiological or psychological strain caused by adverse stimuli, physical, mental or emotional, internal or external, that tend to disturb the functioning of an organism and which the organism naturally desires to avoid*. **[Dorland's medical dictionary, 2000]**

•Thus, stress can be viewed as a process with both psychological and physiological components.

stressor *is any stimulus, situation or circumstance with the potential to induce stress reactions.*

Stressors are forces that have the potential to challenge the adaptive capacity of the organism.

Stressors can be *physical or mental/psychological* (e.g. emotional).

Major stressful life events or more minor daily stressors or hassles.

Stressors acting to produce changes in the body could be *positive* (e.g. exciting, pleasurable), leading to a response state defined as '***Eustress***', or stressors could be *negative*, threatening homeostasis with pain, discomfort and physical pathology; the negative response state is '***Distress***' **(*Seyle, 1976*).**

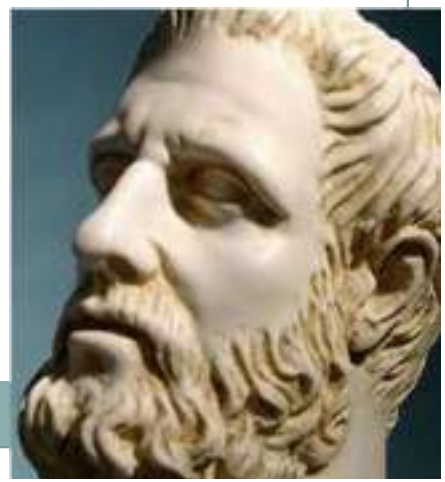
Reactions of a body to forces of a deleterious nature, infections and various abnormal states that tend to disturb its normal physiologic equilibrium (homeostasis).
(GPT)

Stimuli that, when impinging upon an individual, produce disequilibrium. Should these compensating reactions be inadequate or inappropriate, they may lead to disorders. (GPT)

HISTORICAL BACKGROUND AND BASIC CONCEPTS

At the heart of the concept of stress is an attempt to understand how the body regulates itself to maintain smooth, adaptive and homeostatic functioning when confronted with disruptive endogenous or exogenous forces.

- **Hippocrates** thought of health as a harmonious balance of the elements comprising the quality of life while disease represented disruption or disharmony among those elements.



- **1. The Initial response** – Alarm reaction – No significant changes.

- **2. The Adaptation to stress – The Resistance stage.**

- **3. The Final stage (Inability to maintain adaptation to the stress) – The Exhaustation stage –**

  a) osteoporosis of alveolar bone.

  b) epithelial sloughing & degeneration of the PDL.

  c) Reduced osteoblastic activity in chronic stage.

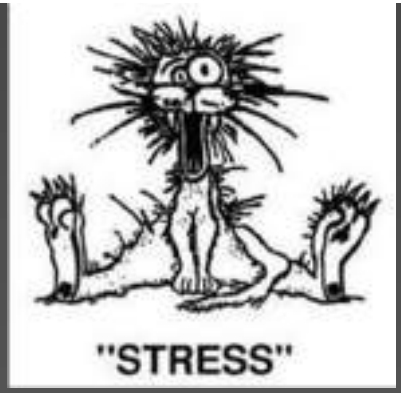
  d) Apical migration of epithelial attachment and formation of periodontal pockets.

  e) Delayed healing of the connective tissues.

RESPONSE TO STRESS

The two main systems involved are the Hypothalamic-Pituitary-Adrenal (HPA) Axis and the Sympathetic nervous system.

Triggered (activated) primarily by an area in the brain stem (lowest part of brain) called the **Locus coeruleus**, the sympathetic nervous system secretes Nor-epinephrine.



Stimulates

ANTERIOR HYPOTHALAMUS

Secrets

CORTICOTROPIN RELEASING FACTOR (CRF) & ARGININE VASOPRESSIN

PITUTARY GLAND (HYPOPHYSIS)

PITUTARY GLAND

releases

ADRENOCORTICOTROPHIC HORMONE (ACTH)

Acts on

ADRENAL CORTEX

INCREASE IN PRODUCTION & RELEASE OF GLUCOCORTICOID HORMONES

The glucocorticoids then produce a myriad of effects throughout the body, such as

--> suppressing the inflammatory response
--> modifying cytokine profiles
--> elevating blood glucose levels
--> altering levels of certain growth factors.

The **Autonomic Nervous System (ANS)** is also activated to induce release of *Adrenaline* or Epinephrine from the adrenal medulla, while various neuropeptides such as substance P are released from sensory nerve fibers **(Bartold et al 1994)**

Under ideal circumstances these factors function in harmony to enable the organism toward off the stressful event and maintain homeostasis. A well-known example of this is the so-called "**flight or fight**" response to potentially harmful stimuli.

In contrast, increased levels of cortisol and epinephrine may disrupt homeostasis and lead to increased susceptibility to disease **(Chatterton RT et al 1997).**

Pathophysiology of Stress

Environmental influences

Major life events

Pshycological factors

Daily hassles

Systemic illlness

Poor coping strategies

Hypothalamus

Anterior pituitary

Adrenal cortex

⬆ Cortical Secretion

Health impairing behaviours

ANS

Adrenal medulla

⬆ Epinephrine & norepinephrine Secretion

Suppressed Inflammatory Response

⬆ Blood glucose Levels

Altered growth Factor levels

Altered cytokine Levels

Poor oral hygiene

Cigarette & alcohol Consumption

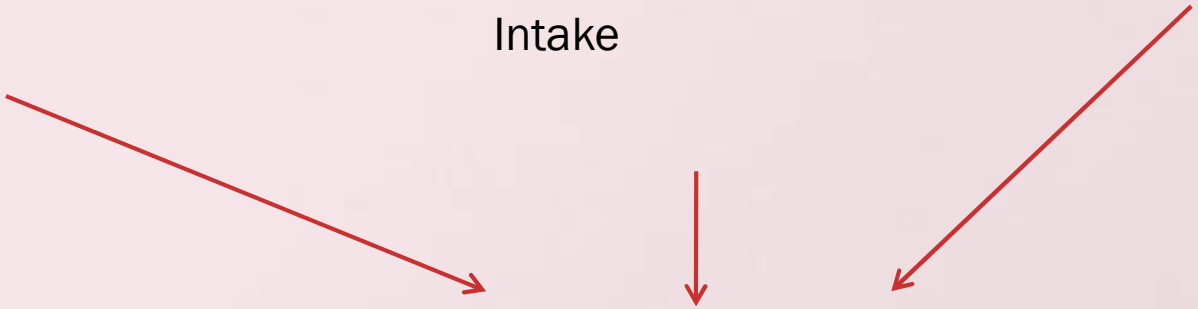
Forgtefulness & Difficulty concentrating

Disturbed sleeping patterns

Poor nutritional Intake

⬆ Blood glucose levels

Altered immune cell function



Increased susceptibility to periodontal disease

Effect of Stress on Immune System

- There is increasing evidence that the central nervous system (CNS) can influence the immune response via a complex network of bidirectional signals linking the nervous, endocrine and immune systems.

- Psychological stresses can downregulate immune responses by altering t within this network.

2 MAIN PATHWAYS LINK THE BRAIN AND IMMUNE SYSTEM

Hypothalamic-Pituitary-Adrenal (HPA) Axis

AUTONOMIC NERVOUS SYSTEM

- Neuroendocrine hormones released from the pituitary gland by the activation of the HPA axis influence the immune system.

- Both lymphoid and myeloid cells express receptors for these hormones and neuropeptides, several studies have demonstrated that lymphocytes can also synthesize hormones such as prolactin, growth hormone and adrenocorticotropic hormone (ACTH).

- Lymphocytes
- Monocytes
- Macrophages
- Granulocytes

All possess receptors for many neurotransmiters and these neurotransmitters alone are capable of immune regulation.

Role of Stress in periodontium

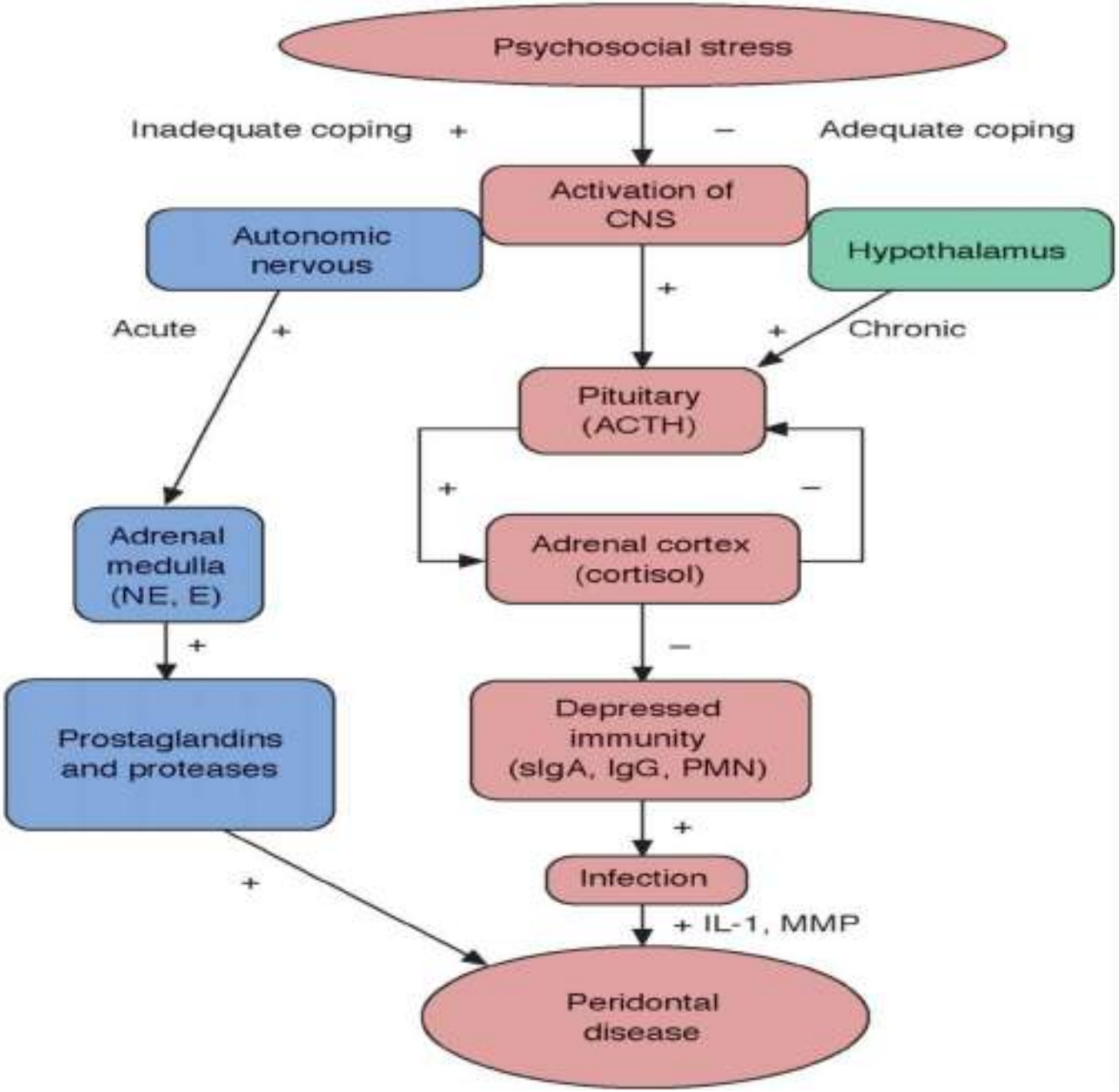
- An association between stress and periodontal disease was suggested over 50 years ago *(Dean MT, Dean RD, 1945)* and has subsequently been supported by several studies *(Deinzer R, 1998; Sakki TK 1995).*

- Models include elaboration of stressors from both the physical and psychosocial domains that may serve as risk factors for periodontal disease.

- The literature relating stress to periodontal disease focuses on psychosocial stressors and their influences on susceptibility to gingival infection and/or the inflammatory aspects of periodontal disease.

- In addition, both smoking and diabetes act as physical stressors capable of activating the stress–immune system.

Schematic representation by GENCO

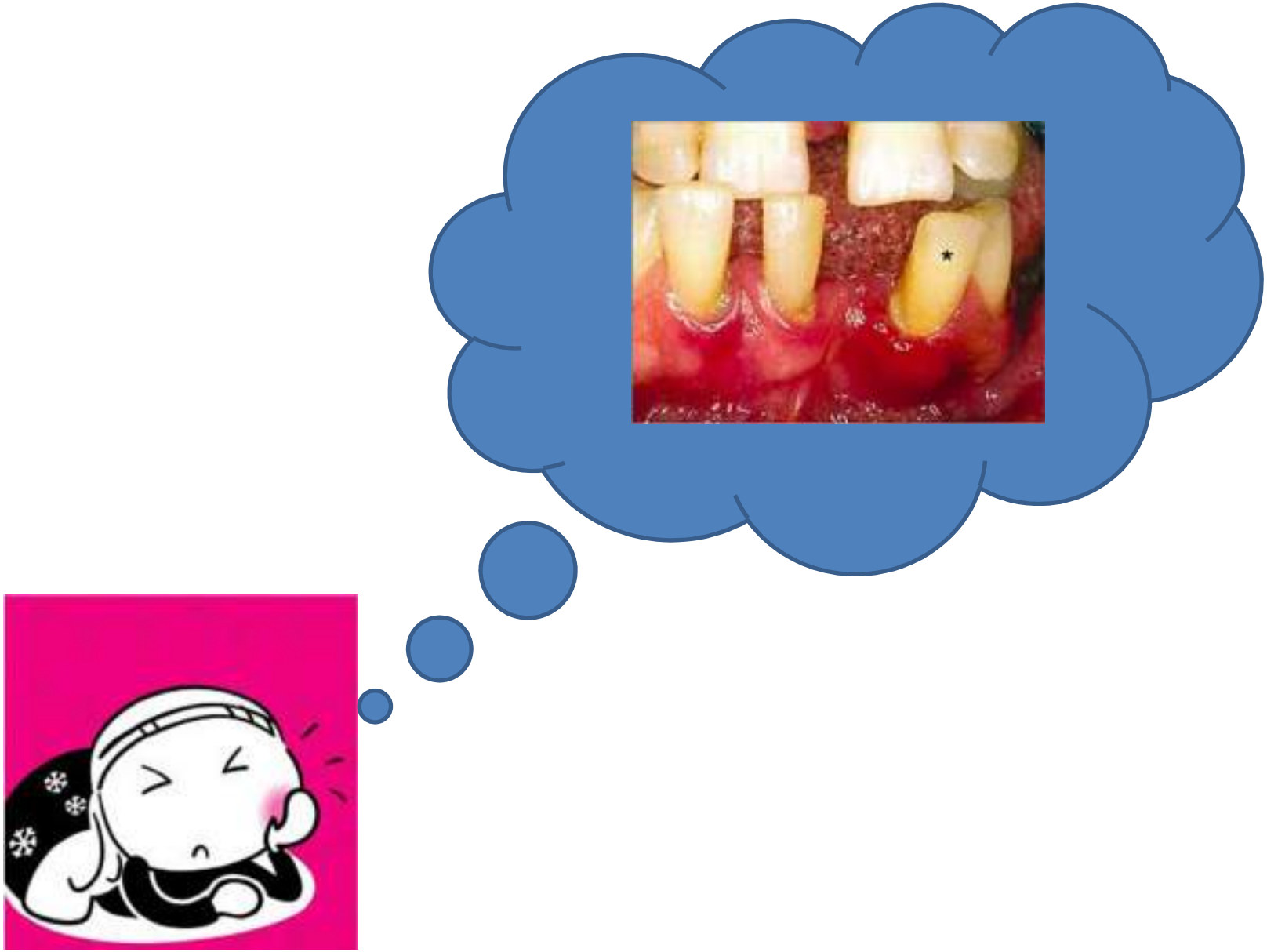


WOUND HEALING & STRESS

- Numerous studies have reported an increased **susceptibility to systemic diseases and delayed wound healing** in both animals and humans who are subjected to prolonged physical or emotional stress **(Riley L 1981, Shapira L, 2000).**

Periodontal destruction and stress

- *AGGRESSIVE PERIODONTITIS & STRESS*



- **Monteiro da Silva et al.** (1995) reported psychosocial factors **(depression and loneliness)** were more prevalent in patients with **aggressive periodontitis** than in to those with chronic periodontitis or periodontal health.

Trauma and stress

- **Hugoson et al.** (2002) evaluated 298 individuals between the ages of 50 and 80.

- They reported that **traumatic life events** were associated with increased risk for periodontal disease, especially in those individuals with poor coping skills as expressed in their locus of control perception.

TREATMENT & STRESS

- Studies of this nature offer significant support to the concept that properly coping with stressful life events may be more important than the events themselves. **Axtelius et al. (**1998) investigated **psychosocial strain** in a small group of patients in relation to their response to periodontal therapy.

- They reported that response to therapy was less in those individuals with more psychosocial stress and a more passive-dependent personality.

GENETICS & STRESS

- **Breivik et al. (2000)** studied two genetic strains of Wistar rats, one of which responded to stress by high corticosteroid production while the other expressed low corticosteroid secretion

- Those that produced high levels of corticosteroids were more sensitive to periodontitis, suggesting that genetic factors may determine periodontal disease susceptibility.

NUG AND STRESS

- The incidence of necrotizing ulcerative gingivitis increases during periods of physiologic and emotional stress and, as a result, stress has long been recognized as one of the contributing factors for necrotizing ulcerative gingivitis.

- Necrotizing ulcerative gingivitis appears to be diminishing in frequency among immunocompetent individuals and its diagnosis indicates the need for evaluation of the patient's immune system, including testing for HIV ***(Rees, 2002; Roland et al, 1999).***

The disease has been reported to be more common among *college students at examination time*, among individuals adjusting to military life, soldiers in combat or those undergoing other stressful events ***(Pindborg 1951, Pennel, 1977)***.

- It has been associated with *anxiety and depression* and several authors have reported significantly elevated cortisol levels in individuals with NUG that returned to normal after recovery ***(Shannon, 1969).***
- This suggests involvement of the neuroendocrine system leading to lymphocytopenia, alterations in chemotaxis, phagocytosis and killing by polymorphonuclear leukocytes and macrophage dysfunction ***(Roland, 1999).***

- These immune complex changes have also been associated with blood dyscrasias, malnutrition, malignancy and other debilitating diseases and these conditions have all been associated with in increased incidence of NUG **(*Roland, 1999*).**


Smoking and stress

- Psychologically depressed human subjects who smoked and had high titers of IgG against T. forsythia were found to have more severe and extensive chronic periodontitis; the authors explained this by the negative influence of depression on the immune system ***(Moss et al, 1969).***

- Smoking impairs collagen synthesis and increased MMP 8 levels in blister wound **(Knwtinen A et al 2002)**

PSYCHOSOMATIC DISTURBANCE IN RELATION TO PERIODONTIUM

- The etiology of inflammatory periodontal disease is complex. The etiological significance of biological and behavioral risk factors, including systemic conditions, smoking, oral hygiene and age has been demonstrated.

- However, a significant proportion of the variation in disease severity cannot be explained by taking only these factors into consideration.

- Harmful effects that result from psychic influence on the organic control of tissues are known as **psychosomatic disorders**.

- There are two ways, in which psychosomatic disorder may be induced in the oral cavity,
- (1) Through the development of habits that are injurious to the periodontium.
- (2) By the direct effect of the autonomic nervous system on the physiologic tissue balance.

Psychosomatic factors:

- 1. Oral hygiene negligence.
- 2. Changes in dietary intake.
- 3. Smoking and other harmful habits.
- 4. Oral habits.
- 5. Bruxism.
- 6. Gingival circulation.
- 7. Alteration in salivary flow & components.
- 8. Endocrine Changes.
- 9. Lowered host resistance.
- 10. Stress.

MECHANISM OF ACTION OF PSYCHOSOMATIC FACTORS ON PERIODONTAL TISSUES

- **ORAL HYGIENE NEGLIGENCE:**

  It is obvious that proper oral hygiene is partially dependent on the mental health status of the patient.

  Some patients may be disturbed or distracted psychologically so that personal hygiene is neglected. Other patients may intentionally ignore oral hygiene to fulfill deep neurotic needs.

- **Moulton** and **Ewen (1952)** suggested that oral hygiene may be neglected during depression, deep anxiety and rebellion against authority.

- The dentist's instructions concerning oral hygiene may be ignored as a form of "Parental defiance" (**Sword 1970**).

- **Belfiny** and **Gupta (1961)** compared psychiatric patients with controls and found that the severity of periodontal disease increased significantly in both groups as the level of calculus increased. They also found more moderate and heavy calculus in the psychiatric group than the control group.

CHANGES IN DIETARY INTAKE:

- Emotional conditions are thought to modify dietary intake, thus indirectly affecting periodontal status (**Moulton et al 1952, Meyer 1989**).
- This can involve for instance, the consumption of excessive quantities of refined carbohydrates and softer diets, requiring less vigorous mastication and therefore predisposing to plaque accumulation at the proximal risk sites (**Newman 1974**).

SMOKING:

- Smoking potentially acts by affecting tissue moisture or temperature has been related to the etiology for NUG and other oral diseases as well. Smoking is also inversely related to many psychosocial variables associated with mental health.
- Understanding the cytotoxic effects of tobacco use as well as the nature of nicotine dependency is essential for adequate patient management.

- Brain metabolism initially increases and then stabilizes in the presence of nicotine.

- With repeated exposure, CNS stimulation by nicotine gradually wanes and the presence of nicotine becomes necessary to ward off withdrawal symptoms.

- Nicotine dependence is not only a “risk factor” for other diseases, but is a disease requiring treatment in its own right.

- **Pindborg (1951)** reported that 98% of the ANUG patients were smokers and that the frequency of ANUG increased with an increasing exposure to tobacco smoke. It has not been established whether this correlation occur because,
- (1) Tobacco smoking has a direct toxic effect on the gingiva
- (2) Vascular or other changes are induced by nicotine or other substance
- (3) Smoking and ANUG are both reflections of stress.

- **Kenney et al** mentioned that the circulating nicotine have following effect,

- (1) Vasoconstriction, produced by the release of Adrenaline and non-Adrenaline, which is supposed to result in lack of nutrients for the periodontal tissue
- (2) Suppression of secondary antibody responses
- (3) Inhibition of oral neutrophil functions.

STRESS MANAGEMENT BY PATIENTS:

- There are several ways of coping with stress. Some techniques of time management may help a person to control stress.

- In the face of high demands, effective stress management involves learning to set limits and to say "No" to some demands that others make.

- The following techniques have been recently dubbed “Destressitizers” by The Journal of the Canadian Medical Association.

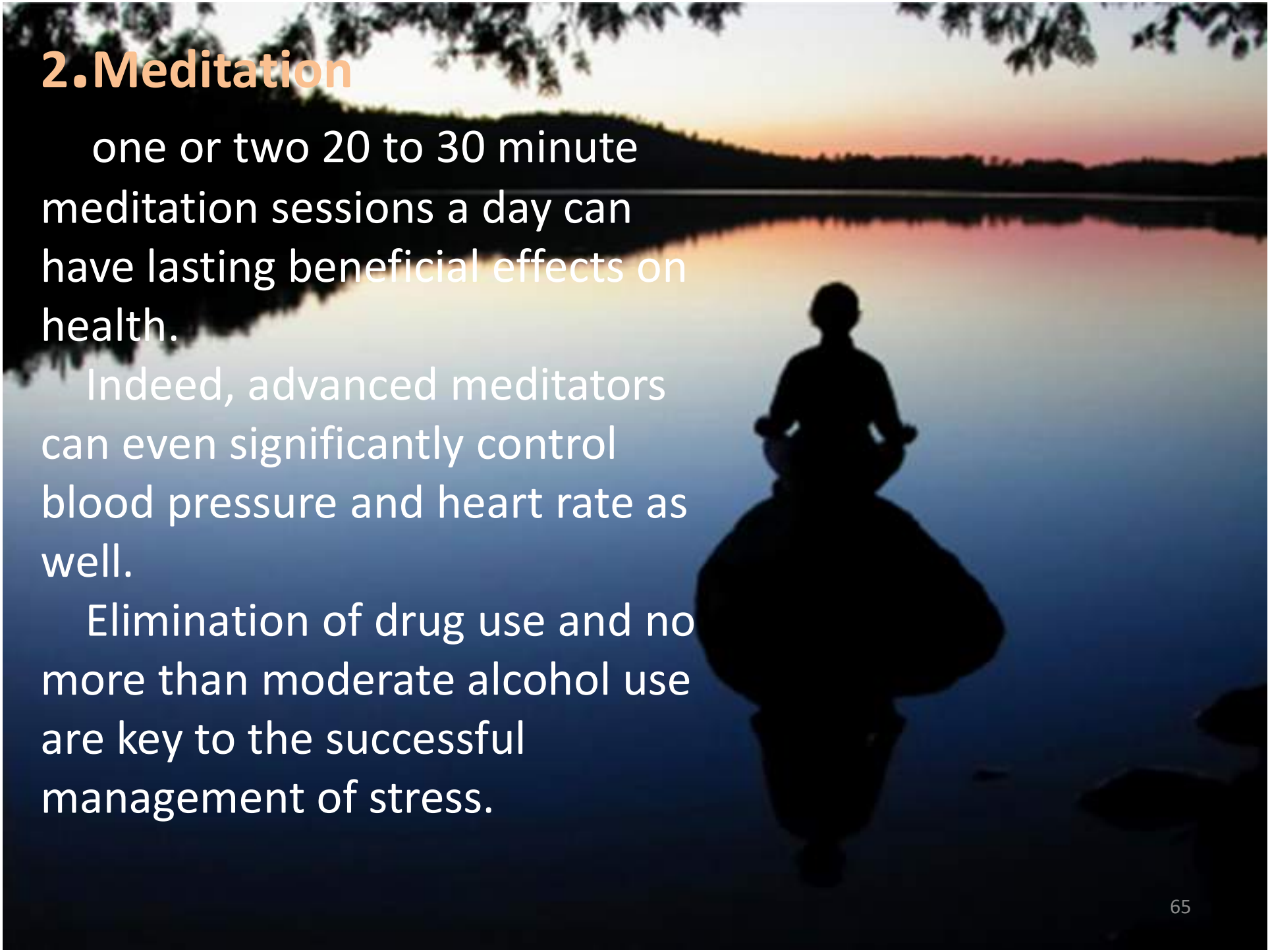
- A destressitizer is any process by which an individual can relieve stress.

- Techniques of stress management will vary according to the theoretical paradigm adhered to, but may include some of the following:

- **1. Exercise**

Exercise on a regular basis helps to burn off and use up the stress hormones and neurochemicals.

Thus, exercise can help avoid the damage to our health that prolonged stress can cause.



2.Meditation

one or two 20 to 30 minute meditation sessions a day can have lasting beneficial effects on health.

Indeed, advanced meditators can even significantly control blood pressure and heart rate as well.

Elimination of drug use and no more than moderate alcohol use are key to the successful management of stress.

Strengthen your relationships

- A strong support network is your greatest protection against stress.
- When you have trusted friends and family members you know you can count on, life's pressures don't seem as overwhelming.

- So spend time with the people you love and don't let your responsibilities keep you from having a social life.
- If you don't have any close relationships, or your relationships *are* the source of your stress, make it a priority to build stronger and more satisfying connections.


Tips for reaching out and building relationships:
Help someone else by volunteering.
Have lunch or coffee with a co-worker.
Call or email an old friend.
Go for a walk.
Schedule a weekly dinner date
Take a class or join a club

CONCLUSION

•Studies to date strongly suggest that stress, distress and inadequate coping are important risk indicators for periodontal disease.

• The data suggest that the immune changes induced by stress appear to be large enough to be a health risk.

•Furthermore, since stress dysregulates inflammatory and immune responses, stress can affect the course of oral wound healing and affect the management of

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