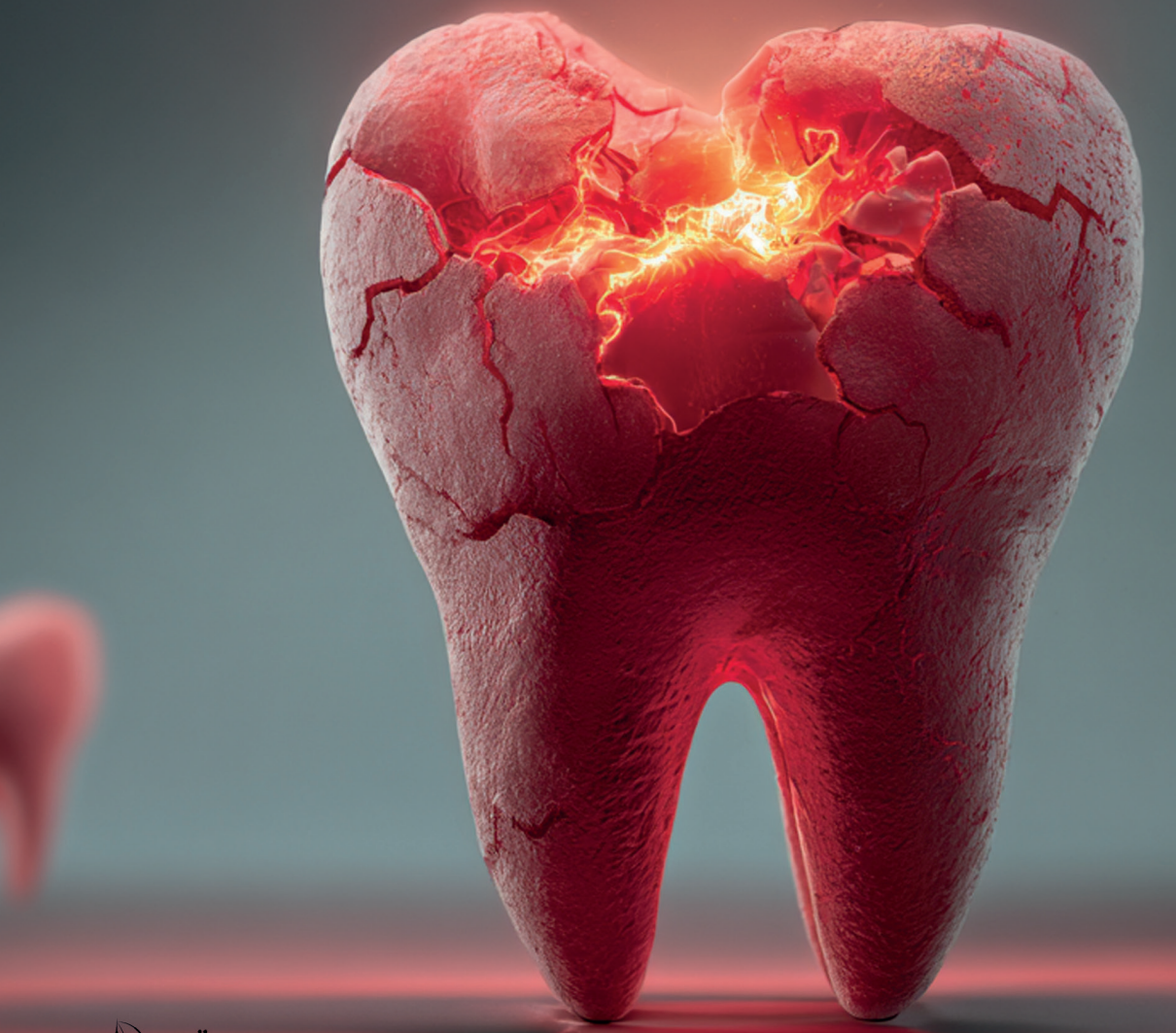
INTERNATIONAL STUDIES IN PERIODONTICS, VOL. I

UZM. DT. MUHAMMED FURKAN ÖZCAN



SERÜVEN YAYINEVİ

Genel Yayın Yönetmeni / Editor in Chief • C. Cansın Selin Temana

Kapak & İç Tasarım / Cover & Interior Design • Serüven Yayınevi

Birinci Basım / First Edition • © Ekim 2025

ISBN • 978-625-8671-45-2

© copyright
Bu kitabın yayın hakkı Serüven Yayınevi'ne aittir.
Kaynak gösterilmeden alıntı yapılamaz, izin almadan hiçbir yolla çoğaltılamaz.
The right to publish this book belongs to Serüven Publishing. Citation can not be shown without the source, reproduced in any way without permission.

Serüven Yayınevi / Serüven Publishing
Türkiye Adres / Turkey Address: Kızılay Mah. Fevzi Çakmak 1. Sokak
Ümit Apt No: 22/A Çankaya/ANKARA
Telefon / Phone: 05437675765
web: www.seruvenyayinevi.com
e-mail: seruvenyayinevi@gmail.com

Baskı & Cilt / Printing & Volume
Sertifika / Certificate No: 47083

INTERNATIONAL STUDIES IN PERIODONTICS, VOL. I

OCTOBER 2025

UZM. DT. MUHAMMED FURKAN ÖZCAN [1]

1 Department of Periodontics / Specialist Dentist
https://orcid.org/0000-0002-7048-0543

CONTENTS

THE IMPACT OF HORMONAL CHANGES ON THE PERIODONTIUM IN WOMEN

PLANNING AND OBJECTIVES IN PERIODONTAL TREATMENT

MANAGEMENT OF ACUTE GINGIVAL INFECTIONS

CONSCIOUS SEDATION IN PERIODONTAL SURGICAL PROCEDURES

PREFACE

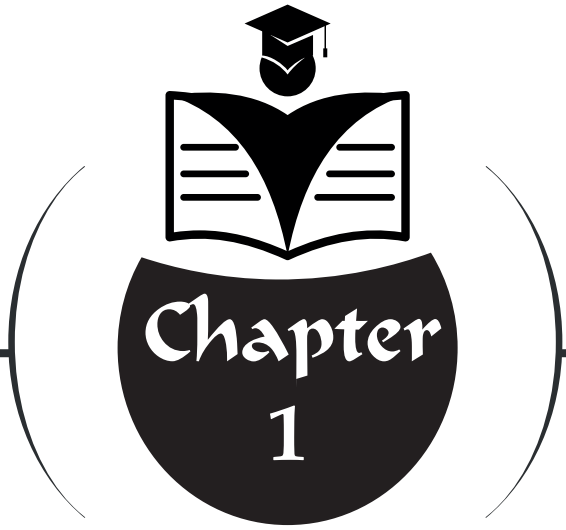
Periodontology, as one of the core disciplines of dentistry, embodies the remarkable organization of human biology that becomes evident at every stage from diagnosis to treatment. Beyond its clinical applications, this field continues to attract great interest through its profound biological foundations and scientific depth.

The conception of this book arose from my enduring curiosity and enthusiasm for periodontology, as well as from my aspiration to share knowledge and experience with colleagues, students, and researchers. I believe that the dissemination of scientific knowledge, the pursuit of lifelong learning, and the exchange of professional experience are essential elements that contribute to the collective advancement of our profession and humanity.

The process of preparing this book has been both scientifically enlightening and personally fulfilling. I am deeply grateful to my family for their constant encouragement and unwavering support throughout this endeavor.

I dedicate this work to all those who have inspired and guided me on my academic journey especially my family, my professors, and my esteemed colleagues.

Muhammed Furkan ÖZCAN
Ankara, Kasım 2025



THE IMPACT OF HORMONAL CHANGES ON THE PERIODONTIUM IN WOMEN

An Overview of the Female Endocrine System

The endocrine system is one of the fundamental physiological systems responsible for maintaining and regulating the body's homeostatic balance through intercellular communication. It functions via a network of organs and glands that synthesize, secrete, and store specific hormones. Hormones are chemical messenger molecules synthesized by specific cells or groups of cells, which are then released into the circulation to exert biological effects on target tissues. When needed by the organism, hormones are secreted into the bloodstream in appropriate amounts and act upon the corresponding target tissues to elicit their effects.

Central endocrine structures include the hypothalamus and pituitary gland, while peripheral endocrine glands comprise the pancreas, pineal gland, thyroid and parathyroid glands, gonads, thymus, intestines, and adrenal glands. (Bates & Bowling, 2013; Leblebicioğlu, Connors & Mariotti, 2013) The pituitary gland, which functions under the control of the hypothalamus in the brain, is the principal regulator of all endocrine glands. The anterior lobe of the pituitary, in particular, is referred to as the "master gland" due to its responsibility for producing a variety of hormones. The hypothalamus plays a central role in the neuroendocrine regulation of the reproductive system by sending signals to the anterior pituitary to control endocrine functions. These signals, which are neurotransmitter-like substances released from neuronal axons, exhibit either stimulatory (releasing) or inhibitory effects on hormone secretion. Moreover, the pituitary gland does not function solely in response to incoming signals but can also regulate itself by providing feedback to the hypothalamus based on its own hormone secretion levels. Feedback signals from target organs such as the ovaries and adrenal glands also significantly influence the secretion of pituitary hormones. (Bates & Bowling, 2013; Leblebicioğlu et al., 2013) As a result, the female reproductive endocrine system, regulated by the hypothalamus and pituitary gland, is a dynamic structure governed by a complex interaction of endocrine, paracrine, autocrine, and feedback mechanisms.

The intricately regulated structure of female reproductive endocrinology begins with the release of gonadotropin-releasing hormone (GnRH) from the hypothalamus. GnRH is secreted in a pulsatile manner by hypothalamic neurons and reaches the anterior pituitary through the portal circulation, where it induces the secretion of gonadotropins - follicle-stimulating hormone (FSH) and luteinizing hormone (LH). FSH supports follicular development in the ovaries and stimulates estrogen synthesis, while LH plays a key role in ovulation and the formation and maintenance of the corpus luteum.

The female reproductive system is regulated through complex feedback loops involving the hypothalamus, pituitary gland, and ovaries. In this

system, the ovaries perform two primary physiological functions: first, the production of female sex steroids - estrogen and progesterone; and second, the periodic release of oocytes through ovulation. (Nippoldt, Reame, Kelch & Marshall, 1989; Bates & Bowling, 2013)

Estrogen Hormone: Biosynthesis, Physiological Roles, and Vascular Effects

The term "estrogen" encompasses three structurally related steroid hormones: estradiol, estrone, and estriol. Among these, estradiol exhibits the highest estrogenic potency, followed by estrone and estriol. During the reproductive period - from menarche to the onset of menopause - estradiol is the predominant circulating estrogen. In the postmenopausal period, however, estrone becomes the dominant form. Estriol is considered the primary estrogen produced by the fetus during pregnancy. (Bates & Bowling, 2013; Leblebicioğlu, Connors & Mariotti, 2013)

Cholesterol serves as the precursor for estrogen biosynthesis. (Figure 1) Cholesterol enters the cell via passive diffusion across the cell membrane and binds to specific nuclear estrogen receptors, which are protein-based. The ligand-receptor interaction initiates transcriptional activation in targeted DNA regions, leading to various cellular and metabolic responses. (Straub, 2007; Mariotti & Mawhinney, 2013) The main sites of estrogen production include developing ovarian follicles, the corpus luteum, the placenta, and the adrenal glands. While the ovaries are the primary source of circulating estrogen in the premenopausal period, in postmenopausal women this function is largely carried out by the peripheral aromatization of adrenal androgens. (Bates & Bowling, 2013; Leblebicioğlu et al., 2013) Estrogen synthesis is initiated by signals from the hypothalamus to the anterior pituitary gland, which in turn secretes follicle-stimulating hormone (FSH) and luteinizing hormone (LH) to regulate estrogen production. (Figure 2)

Estrogen plays a wide range of physiological roles. These include the development and maintenance of secondary sexual characteristics, uterine growth and development, regulation of pituitary gonadotropins through negative feedback mechanisms, thickening of the vaginal mucosa, and breast tissue development. (Bates & Bowling, 2013; Leblebicioğlu et al., 2013) Estrogen also exerts significant effects on vascular structure and function. Estrogen is synthesized within endothelial cells, and these cells' activities are regulated via estrogen receptor-mediated mechanisms. Upon receptor activation, processes such as vasodilation, re-endothelialization, and angiogenesis are stimulated. In addition, there is substantial evidence supporting the direct effects of estrogen on vascular permeability and vessel proliferation. (Straub, 2007; Bates & Bowling, 2013)

A notable association has been observed between estrogen levels and endometrial blood flow. During the follicular phase, rising estrogen levels increase endometrial vascularity and perfusion, whereas a decrease in estrogen during the luteal phase is associated with reduced endometrial blood flow. (Leblebicioğlu et al., 2013)

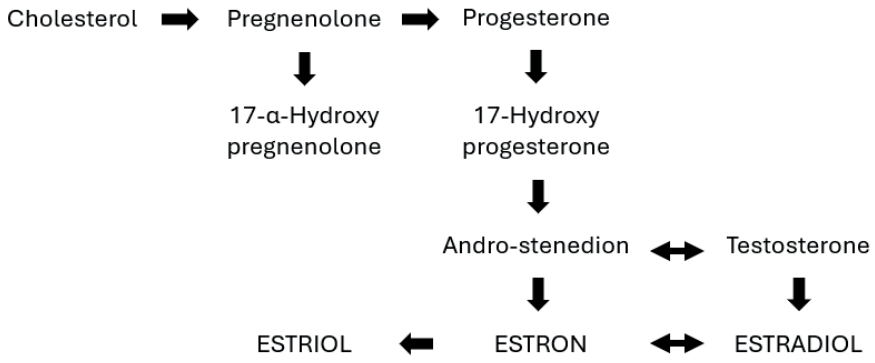


Figure 1. *Estrogen biosynthesis chain.*

Synthesis			**Stimulation**			
Ovaries	**Placenta**	**Adrenal Gland**				
Estradıol and Estron	*Estriol*	*Estron and small amounts of Estradiol*	Hypothalamus	GnRH	Anterior pituitary gland	FSH, LH

Figure 2. *Synthesis and stimulation of estrogen, FSH and LH hormones.*

Progesterone: Structure, Physiological Roles, and Vascular Effects

Progesterone is a member of the progestin group, a class of steroid hormones structurally similar to estrogens. This hormone is primarily responsible for endometrial development and differentiation and plays a critical role in the maintenance of pregnancy. During the luteal phase of the menstrual cycle, elevated progesterone levels prepare the endometrium for implantation. Conversely, the decline in progesterone levels at the end of the cycle serves as a key signal for the onset of menstruation. (Straub, 2007; Mariotti & Mawhinney, 2013)

Progesterone is synthesized by the adrenal glands, ovaries, and - during pregnancy - the placenta. In the premenopausal period, the corpus luteum of the ovary serves as the primary source of progesterone, whereas in pregnancy, the placenta becomes the main site of production. Unlike estrogen, progesterone has limited direct effects on blood vessels and vascular structures. Moreover, progesterone can antagonize the vascular effects of estrogen by downregulating the expression of estrogen receptors. Through this mechanism, progesterone plays a balancing role against the proliferative actions of estrogen. (Straub, 2007; Mariotti & Mawhinney, 2013)

Estrogen	Progesterone
It may influence the vascular response by stimulating angiogenesis.	It plays an influential role in vascularization.
It may increase vascular permeability by stimulating the release of histamine, bradykinin, and prostaglandin E.	By stimulating the release of prostaglandin E, it may lead to an increase in vascular permeability. The enhancement of vascular dilation and permeability may promote inflammatory cell infiltration and oxidative stress.
By influencing collagen metabolism, it may regulate connective tissue homeostasis; alterations in collagen turnover may support gingival fibroblast proliferation as well as the processes of connective tissue maturation and remodeling.	It may modulate collagen structure and the rate of its biosynthesis. Its levels during the third trimester have been shown to reduce glycosaminoglycan synthesis.
It may induce the differentiation of cellular responses by modulating the signaling mechanisms of polypeptide growth factors that act through autocrine and paracrine pathways.	By enhancing folate metabolism, it may accelerate the degradation of folate, which plays a critical role in tissue repair.
By altering the redox potential, it may modulate the activity of salivary peroxidase, which exhibits antimicrobial activity against various microorganisms.	By reducing plasminogen activator inhibitor-2 (PAI-2) levels, it may increase tissue proteolysis.
While increasing fibroblast proliferation, it reduces the production of proinflammatory cytokines such as IL-6 and IL-8; simultaneously, it elevates growth factor levels, decreases protein synthesis, and modulates the functions of specific fibroblast populations.	It decreases fibroblast proliferation, protein synthesis, and cytokine production.
It exhibits effects that enhance keratinization and epithelial proliferation.	It exerts a more catabolic effect, resulting in a reduction of keratinization.
It affects fibroblast proliferation and collagen maturation in gingival connective tissue. However, data regarding its effects on the metabolism of periodontal ligament-derived fibroblasts remain insufficient. Estrogen may regulate progesterone activity by upregulating the expression of progesterone receptors.	

Table 1. *Effects of estrogen and progesterone hormones on tissues.*

Effects of Sex Steroid Hormones on Periodontal Tissues

Gingival tissues are among the target organs of sex steroid hormones due to the presence of estrogen and progesterone receptors. In this context, physiological fluctuations in sex steroid hormone levels can exert various effects on gingival tissue. It has been demonstrated that increases in systemic hormone levels are paralleled by elevated concentrations of these compounds in saliva and gingival crevicular fluid (GCF). (Güncü, Tözüm & Çağlayan, 2005; Mariotti, 2008)

The effects of estrogen and progesterone on periodontal tissues are mediated through several mechanisms, which can be summarized as follows:

- ✓ Modulation of gingival vascularization
- ✓ Regulation of fibroblast and epithelial cell functions
- ✓ Influence on the local immune response
- ✓ Alterations in the microbial ecology of the periodontal sulcus/pocket

Similar to the vascular adaptations observed in the female reproductive system, gingival blood vessels are responsive to sex steroid hormones. Although estrogen is well recognized as a key regulator of vascular permeability and proliferation in reproductive organs, several studies suggest that progesterone may also play a significant role in increasing gingival vascular permeability. (Mariotti & Mawhinney, 2013; Otomo-Corgel, 2013) However, based on the current literature, gingival vascular permeability and proliferation appear to be primarily regulated by estrogen, while the effects of progesterone on endothelial cells remain more limited.

Research indicates that gonadal hormones can influence the functions of periodontal ligament fibroblasts, gingival fibroblasts, and epithelial cells. (Mariotti, 1994; Mariotti & Mawhinney, 2013; Kumar, 2013) Gingival cells not only metabolize these hormones but also express steroid hormone receptors. As a result, these hormones may directly modulate cellular secretion and proliferative activity. Gingival inflammation, hyperplasia, and desquamative lesions observed during periods of hormonal fluctuation are thought to be mediated through signaling molecules released by epithelial and fibroblast cells. However, it remains unclear whether these cellular changes are directly induced by sex steroid hormones or mediated through hormone-induced autocrine or paracrine growth factors.

Changes observed in periodontal tissues during periods of increased hormonal secretion have also been linked to alterations in immune cell activation. Interactions between the immune and endocrine systems may intensify the periodontal response during hormonal fluctuation. (Shiau &

Reynolds, 2010; Mariotti & Mawhinney, 2013) Additionally, variations in hormone levels detected in the gingival crevicular fluid (GCF) may influence the microbial ecology of the periodontal sulcus, potentially facilitating the colonization of pathogenic microorganisms. (Kumar, 2013)

Physiological Fluctuations of Estrogen and Progesterone Levels and Their Role in the Female Life Cycle

Physiological fluctuations in estrogen and progesterone levels regulate numerous critical stages throughout a woman's life, from the onset of puberty to menstrual cycles, pregnancy, and menopause. These hormonal changes primarily serve to maintain the body's homeostatic balance.

The female reproductive system, based on its hormonal and physiological characteristics, is divided into three main phases:

1. **Reproductive Phase:** This phase begins with the onset of the first menstrual period and extends until the perimenopausal period, when menstrual cycles begin to become irregular.

2. **Menopausal Transition Phase (Perimenopause):** Characterized by variability in menstrual cycle length and the occurrence of skipped cycles, with no menstruation observed for at least 60 days. This phase concludes with the final menstrual period.

3. **Postmenopausal Phase:** Begins following the last menstruation, with a definitive diagnosis of menopause requiring 12 consecutive months without menstruation. (Edwards, 2013)

In addition to these primary phases, other significant conditions causing hormonal fluctuations in women include the use of estrogen- and progesterone-containing oral contraceptives for pharmacological purposes and hormonal imbalances associated with polycystic ovary syndrome (PCOS).

Hormonal Changes During Puberty and Their Periodontal Effects

Puberty begins when the body reaches a certain age, triggering the brain to secrete specific hormones that facilitate the transition from childhood to adulthood. During this process, the previously suppressed hypothalamus initiates pulsatile secretion of gonadotropin-releasing hormone (GnRH). The released GnRH stimulates the anterior pituitary gland to secrete luteinizing hormone (LH) and follicle-stimulating hormone (FSH). LH and FSH, in turn, stimulate the ovaries to release estrogen and progesterone, leading to the onset of the menstrual cycle. This sequence enables the prepubertal girl to transform into an adult woman capable of fertility. To evaluate the effects of hormonal changes during puberty, skeletal maturity, chronological age, and the Tanner staging system have been utilized. The Tanner staging system divides puberty

into five stages, beginning with the prepubertal phase and ending with mature adulthood. (Kumar, 2013) According to these assessments, puberty typically begins around the age of 10 in girls and lasts approximately four years.

During puberty, a marked increase in estradiol levels is observed. This physiological change is associated with an enhanced inflammatory response to existing dental plaque. Clinically, this period is characterized by signs such as bleeding tendency and enlargement of marginal and interdental gingival tissues. Gingival enlargements are more commonly seen in areas with excessive plaque and calculus accumulation. Inflamed tissues may appear erythematous, friable, lobulated, and mobile. (Melaley and Moritz, 2003; Otomo-Corgel, 2013) Studies have demonstrated a positive correlation between serum estradiol and progesterone levels and the gingival index. Additionally, selective increases in black-pigmented anaerobic rods, primarily *Porphyromonas intermedia*, have been reported during puberty, similar to observations in pregnancy. (Gusberti et al., 1990; Nakagawa et al., 1994) Longitudinal and cross-sectional studies have shown that the heightened gingival response to plaque during puberty is a transient phenomenon. Although the increase in gingival inflammation is attributed to puberty, variations exist across studies regarding the severity, prevalence, and onset timing of this inflammation. (Mariotti and Mawhinney, 2013)

The effects of increased hormones during puberty on the gingival sulcus microbiota can be categorized into two main aspects: (Kumar, 2013)

1. Changes in Microbial Composition: Significant alterations occur in the subgingival microbial composition before, during, and after puberty. These changes resemble the microbial profiles observed in young adults. While the presence of periodontal disease substantially influences the microbial composition, no significant differences in disease-associated flora have been found between pubertal children and young adults.

2. Density and Prevalence of Black - Pigmented Bacteroides Species: Puberty induces pronounced changes in the subgingival ecosystem. Increases in *Veillonella*, *Streptococcus*, *Capnocytophaga*, *Fusobacterium*, *Prevotella*, and *Actinomyces* species have been observed during this period. The counts of black-pigmented Bacteroides species rise before, during, and after puberty, paralleling the increase in gingival inflammation. However, only one study has reported a direct correlation between increased steroid hormone levels during puberty and the quantity of these microorganisms; other studies have not conclusively established this link.

In conclusion, based on current evidence, it can be stated that the increase in gingival inflammation correlates more strongly with the levels and prevalence of black-pigmented Bacteroides species than the rise in steroid hormone levels.

Menstrual Cycle and Its Effects on Periodontal Tissues

The average age of menarche is approximately 12 years, and the normal cycle length is about 28 days. Each month, the female body prepares for pregnancy; if fertilization does not occur, the endometrium - the inner lining of the uterus - is shed through menstrual bleeding. The primary purpose of the menstrual cycle is to ensure ovum maturation and ovulation, as well as to prepare the uterus for the implantation of a fertilized ovum. (Bates & Bowling, 2013)

The menstrual cycle consists of the follicular and luteal phases. During the follicular phase, estrogen and follicle-stimulating hormone (FSH) promote the maturation of the ovary and the thickening of the uterine lining. The follicle, which is the basic structural and functional unit of the ovary, comprises the oocyte, thecal cells, and granulosa cells. A group of follicles begins to develop independently of hormonal stimulation each cycle. As FSH levels rise, granulosa cells increase the number of FSH receptors; the follicle that develops the highest number of FSH receptors is selected as the dominant follicle. The dominant follicle also begins to form luteinizing hormone (LH) receptors on thecal cells, thereby increasing the steroid amount convertible to estrogen. The developing follicle secretes increasing amounts of estrogen, supporting oocyte development. Follicular development progresses through the primordial, primary, secondary, and Graafian follicle stages.

Following ovulation, the estrogen-producing dominant follicle transforms into the corpus luteum and begins producing progesterone; this process is termed luteinization. Progesterone stabilizes the endometrial lining. Post-ovulation progesterone secretion is regulated by LH. During this phase, progesterone inhibits the secretion of LH and FSH, preventing the development of new follicles. If fertilization does not occur, the corpus luteum degenerates, estrogen and progesterone levels fall, and the endometrium is shed via menstruation. Rising FSH levels then initiate the start of a new cycle. If fertilization occurs, the corpus luteum continues to synthesize estrogen and progesterone, with placental hormone production eventually taking over. (Bates & Bowling, 2013; Mariotti & Mawhinney, 2013)

Although no significant clinical changes are usually observed in the menstrual phase, some clinical manifestations have been reported in the oral cavity. A very small number of women exhibit oral mucosal ulcerations, vesicular lesions, and bleeding during ovulation and a few days before menstruation. More commonly observed findings include asymptomatic and subclinical increases in gingival crevicular fluid (GCF), indicative of mild inflammation. (Mariotti & Mawhinney, 2013; Kumar, 2013) Studies have reported that gingival exudate peaks just before ovulation, coinciding with the phase when estradiol and progesterone reach their highest levels.

However, most studies emphasize that this increase in GCF occurs in the presence of existing gingivitis. Many women with normal menstrual cycles and without gingivitis reportedly exhibit minimal or no hormonal effects on gingiva. (Otomo-Corgel, 2006; Mariotti, 2008)

In conclusion, the effects of hormonal fluctuations during the menstrual cycle on gingival tissues have yet to be clearly defined. Similarly, evidence regarding changes in subgingival biofilm composition throughout the cycle is limited, and definitive conclusions cannot be drawn. (Gougeon, 1986)

Polycystic Ovary Syndrome (PCOS)

Polycystic ovary syndrome (PCOS) is characterized by excessive androgen production that disrupts the normal maturation of follicles and oocytes within the ovaries, and is identified by the presence of numerous immature follicular cysts in enlarged ovaries on ultrasonography. For a definitive diagnosis, at least two of the following symptoms must be present: absence of other hormonal pathologies, menstrual irregularities, clinical or laboratory findings indicative of hyperandrogenism, and morphologically multiple cysts in the ovaries. (Bates & Bowling, 2013) Women with PCOS may also exhibit morphological changes such as hirsutism, characterized by excessive hair growth including mustache and beard-like patterns, and atypical fat distribution leading to obesity. The treatment approach primarily aims to restore hormonal balance by reducing androgen synthesis. Although conclusive evidence is lacking, studies have reported that gingivitis is commonly observed in patients with PCOS, with an increased risk of periodontitis, potentially associated with elevated levels of proinflammatory cytokines such as IL-6 and TNF-α. (Özçaka et al., 2012)

Effects of Hormones on Periodontal Tissues During Pregnancy

The birth of a healthy infant is a unique indicator of the successful orchestration of the complex and precise functioning of the reproductive endocrine system that occurs monthly. Upon fertilization, the endometrium thickens to facilitate embryo implantation; this process is supported by an increase in progesterone secreted by the corpus luteum. During the first seven weeks of pregnancy, progesterone production originates from the corpus luteum, after which the placenta assumes hormonal production. The placenta acts as an active endocrine organ responsible for regulating hormonal homeostasis throughout pregnancy. Estrogen, produced by the fetus primarily in the form of estriol, reaches significantly higher levels during pregnancy compared to the menstrual period, especially in conjunction with

progesterone. (Bates & Bowling, 2013; Mariotti & Mawhinney, 2013) These hormonal elevations affect multiple body systems, including periodontal tissues. First described by Hullihen in the 1800s, this influence manifests clinically and microbiologically as changes associated with increased dental plaque accumulation during pregnancy. These changes include elevated gingival crevicular fluid (GCF) volume, bleeding on probing, increased gingival index scores, deeper periodontal pockets, greater tooth mobility, and alterations in the microbial flora. Clinically, marginal gingivitis and localized gingival enlargement are observed. (Güncü, Tözüm & Çağlayan, 2005; Otomo-Corgel, 2006) Pregnancy gingivitis is characterized by red, hemorrhagic, and edematous gingiva, typically beginning in the second month and progressing until the eighth month. Silness and Löe (1964) reported that despite similar plaque scores during pregnancy, the severity of gingivitis increased. Hugoson (1970) demonstrated that this inflammation correlates with the elevated pregnancy hormone levels. The inflammatory response typically subsides approximately three months postpartum, returning to pre-pregnancy levels.

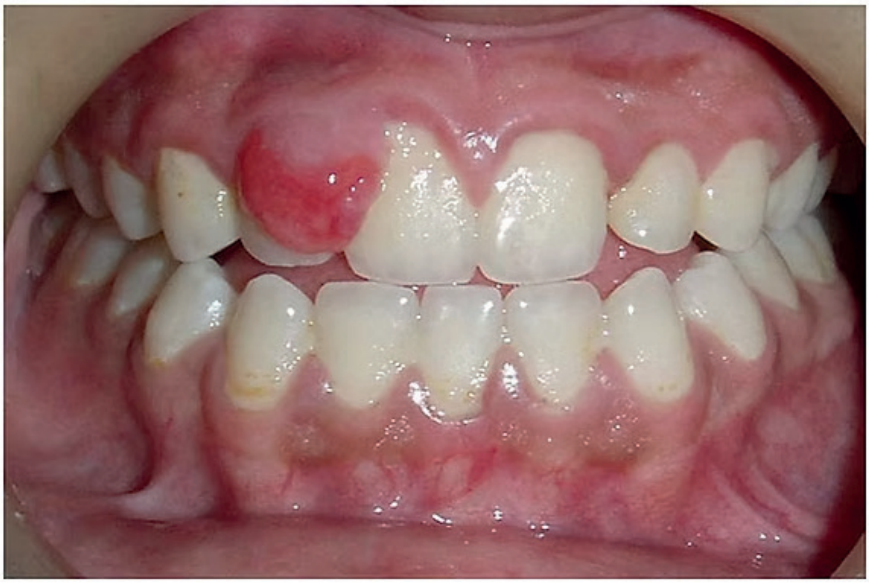


Figure 3. *Pyogenic granuloma (Kobi Mohsseni Jan 14, 2023; https://www.aegisdentalnetwork.com/media/2051)*

The primary effect of hormonal increase is the edema and erythema caused by estrogen and progesterone on the capillary vessels. Additionally, quantitative and qualitative changes occur in gingival crevicular fluid (GCF), creating

a favorable environment especially for gram-negative anaerobic bacteria. Numerous studies have demonstrated that elevated levels of progesterone and estrogen accelerate the growth of subgingival microorganisms, particularly black-pigmented Bacteroides species such as *Prevotella intermedia*. (Kornman & Loesche, 1980) However, some studies have not supported this association. (Yanover & Ellen, 1986) The effect of hormones on the microbial ecosystem suggests that factors other than hormones may also contribute to the increase of *P. intermedia* during the second trimester.

The rise in progesterone and estrogen can reduce keratinization of the gingival epithelium and induce changes in connective tissue matrix metabolism. A study by Otomo-Corgel (2006) reported a 50% decrease in IL-6 production in human gingival fibroblasts incubated with progesterone levels typical of late pregnancy. This reduction may lead to decreased tissue inhibitor levels of matrix metalloproteinases (MMPs) and increased proteolytic enzyme activity, thereby weakening the epithelial barrier function. During pregnancy, not only hormonal but also significant humoral and cellular immune changes occur. Neutrophil chemotaxis and phagocytosis, as well as antibody and CD4+ T cell responses, are suppressed (depressed). These immunomodulatory changes may play a role in the initiation and progression of gingivitis. (Mealey & Moritz, 2003; Otomo-Corgel, 2006)

Pre-existing periodontitis before pregnancy may exacerbate disease severity during gestation. However, some studies have reported no significant differences in attachment loss values during pregnancy and postpartum. (Mariotti, 2008) Pregnancy-associated gingival enlargement (pregnancy granuloma) is not a neoplasm and is clinically and histologically difficult to distinguish from pyogenic granuloma. It is most commonly observed in the maxillary anterior teeth and interproximal regions. (Mariotti, 2008) Vascular changes induced by progesterone, together with the matrix-stimulatory effects of estradiol, particularly facilitate the development of pregnancy granulomas in sites with pre-existing gingivitis. (Mealey & Moritz, 2003) Moreover, local factors such as overhanging restorations, ill-fitting prostheses, and mouth breathing may contribute to increased gingival inflammation. Pregnancy granulomas present as exophytic, pedunculated or sessile lesions, exhibiting a purplish-red to bluish color, are easily bleeding, and generally painless.

Plaque - induced periodontal diseases result from the complex and multifactorial interactions between microbial biofilms and host immune response mechanisms. Although the mechanisms underlying increased gingival inflammation during pregnancy are not fully elucidated, changes in neutrophil functions, alterations in humoral and cellular immunity, modifications in cellular physiology, and shifts in the microbial ecology are thought to play significant roles in this process. (Armitage, 2013)

Menopause and Oral Changes

Common physiological symptoms encountered during menopause in women include hot flashes, insomnia, fatigue, and depressive mood. Female infants are born with approximately 1 to 2 million primary oocytes, but a significant portion of these oocytes are lost before puberty. While the number of follicles at puberty ranges between 300,000 and 500,000, only 400 to 500 follicles complete the ovulation cycle. Each month, several follicles containing oocytes prepare for ovulation, but only one completes this process, while the others undergo programmed cell death (apoptosis). Thus, women lose about half of their oocytes before puberty and continue to lose the remaining ones monthly. Menopause represents the permanent cessation of reproductive function as a result of these cycles. (Bates & Bowling, 2013; Mariotti, 2013) Menopause is defined as the permanent end of ovarian activity with the cessation of menstrual cycles.

Estradiol, the most potent form of estrogen, plays a key role in the reproductive cycle, constituting approximately 60% of circulating estrogen. During menopause, estradiol levels decline and are replaced by estrone, which is secreted from extraglandular tissues and is less potent. Estrone maintains a relatively stable level but exhibits much lower estrogenic activity compared to estradiol. This diminished effective estrogen level causes multiple systemic changes in the body. Systemic effects observed after menopause include vasomotor instability, atrophy in genitourinary tissues, grip impairments, psychological disorders, bone loss, osteoporosis, and cardiac problems. Oral tissues also undergo changes such as mucosal thinning due to decreased collagen in connective tissue, reduced epithelial keratinization, decreased salivary flow, and alterations in bone metabolism. (Geurs, 2007; Mariotti & Mawhinney, 2013)

Common oral clinical findings observed during menopause include:

- ✓ Shiny, easily bleeding, erythematous gingiva
- ✓ Desquamation of the epithelial layer
- ✓ Xerostomia (dry mouth)
- ✓ Burning sensation on the tongue and increased mucosal sensitivity
- ✓ Gingival recession

The age of menopause onset varies widely due to numerous genetic and environmental factors, with an average age in the 50s. Women who experience early menopause have a higher incidence of osteoporosis and a significant reduction in bone mineral density, supporting the anabolic effects of estrogen on bone metabolism. (Geurs, 2007; Tarkkila et al., 2008) Although

the relationship between postmenopausal osteoporosis and periodontal bone loss has not been definitively established, osteoporosis may not directly trigger periodontitis but is thought to increase susceptibility to existing periodontal disease.

Various treatment approaches have been developed to manage these postmenopausal effects. One of the most commonly used methods is pharmacological administration of selective estrogen receptor modulators (SERMs), which aim to exert positive estrogenic effects in specific tissues. Women receiving hormone replacement therapy (HRT) have been reported to show a significant reduction in oral manifestations associated with menopause. (Otomo-Corgel, 2013)

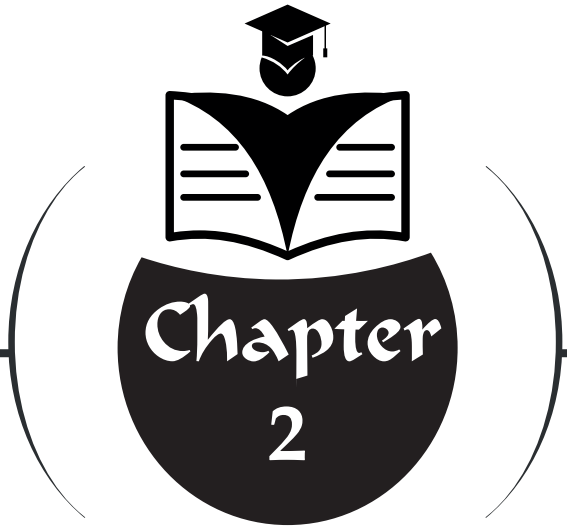
Use of Hormonal Contraceptives

In the early 20th century, scientists hypothesized that hormones secreted by the corpus luteum during pregnancy suppress ovulation. Building on this idea, they successfully identified and isolated the structural compounds of these steroid hormones. Subsequent research demonstrated that high doses of androgens, estrogens, and progesterone inhibit ovulation. As a result of these studies, the first FDA-approved contraceptive drug was introduced in the 1960s in certain states in the United States, and since then, various formulations have been developed for contraceptive purposes. These include combined oral contraceptives containing estrogen and progesterone analogs, progesterone-based "minipills," subcutaneous slow-release progesterone implants, and depot medroxyprogesterone acetate injections administered every three months. (Mariotti, 2008)

Currently, combined hormonal contraceptives (HC) contain low doses of estrogen and progesterone. While some earlier studies reported gingival inflammation associated with HC use, subsequent research has not supported these findings. (Preshaw, Knutson, & Mariotti, 2001) This discrepancy has been attributed to the higher hormone concentrations in formulations used in older studies, which may have influenced the outcomes. The effect of hormonal contraceptives on periodontal tissues varies depending on the formulation used, duration of use, the catabolic effect of progesterone on tissues, and the individual's plaque levels. The shorter the usage duration, the lower the hormone concentration in the formulation, and the lower the plaque index, the less impact hormonal contraceptives have on periodontal health.

Conclusion

The impact of fluctuations in estrogen and progesterone levels on periodontal tissues and the clinical manifestations of these effects have been extensively studied. Strong evidence indicates that the presence of microbial biofilm is essential for the hormonal effects on periodontal tissues to become clinically apparent. However, in the presence of microbial biofilm, these hormones may modify the local tissue response, thereby increasing susceptibility to periodontal diseases.



PLANNING AND OBJECTIVES IN PERIODONTAL TREATMENT

Periodontal treatment planning should be established through a comprehensive evaluation of the data obtained during clinical examination and anamnesis, followed by accurate diagnosis and prognosis determination. During this process, treatment goals and approaches must be carefully defined in accordance with the individual needs of each patient. The patient's systemic condition, attitude toward treatment, and level of cooperation play a critical role in determining the prognosis of both the teeth and overall oral health.

In order to achieve sustainable esthetics, function, and phonation, active periodontal infections must be controlled prior to any restorative or dental implant procedures, as such infections may directly compromise the success of planned restorative interventions.

Key considerations in periodontal treatment planning include: (Lang and Lindhe, 2015; Newman, Takei, Klokkevold, and Carranza, 2015)

✓ The periodontal treatment plan should be formulated only after the diagnosis and prognosis have been definitively established.

✓ Treatment planning must be individualized based on the patient's current periodontal status.

✓ The proposed treatment should encompass all necessary procedures aimed at preserving and reestablishing comprehensive oral health.

✓ Except for urgent cases, no periodontal intervention should begin before the treatment plan is clearly defined.

✓ Unforeseen developments during the course of treatment may necessitate revisions to the initial plan.

✓ The ultimate goal of periodontal treatment planning is to establish a healthy and sustainable periodontal condition.

✓ Due to individual variability, treatment plans must be tailored to the specific needs of the patient.

✓ Factors such as the patient's age, dietary habits, level of oral hygiene, systemic diseases, genetic predisposition, and disease severity are critical in determining both diagnosis and prognosis.

✓ Retaining questionable teeth must be cautiously evaluated, as it may jeopardize the health of the entire dentition.

✓ Periodontal health takes precedence over the mere preservation of the number of teeth.

✓ Teeth that appear clinically salvageable but do not contribute to the functional or biological integrity of the dentition should not be treated.

The scope of periodontal treatment planning encompasses: (Newman, Takei, Klokkevold, and Carranza, 2015)

✓ **Emergency interventions**: Management of acute clinical conditions such as pain and infection.

✓ **Indications for tooth extraction**: Identification of teeth that require extraction due to poor prognosis.

✓ **Periodontal pocket elimination**: Planning of surgical and non-surgical strategies to eliminate periodontal pockets.

✓ **Endodontic treatment needs**: Assessment of endodontic interventions to ensure pulpal and periapical health.

✓ **Occlusal adjustment**: Correction of occlusion, potentially including orthodontic treatment options.

✓ **Dental implant applications**: Implant placement for missing teeth and management of peri-implantitis in existing implants.

✓ **Caries management**: Treatment of carious lesions using appropriate restorative approaches.

✓ **Prosthetic planning**: Determination of necessary prosthetic treatments and selection of abutment teeth.

✓ **Esthetic considerations**: Integration of esthetic expectations into the periodontal treatment plan.

✓ **Treatment sequencing and prioritization**: Organization of treatment phases based on clinical priorities and patient-specific goals.

Unpredictable situations that may arise during the course of treatment can require modifications to the initial treatment plan. Nevertheless, aside from emergency conditions, clinical procedures should not be initiated without the development of a comprehensive treatment plan.

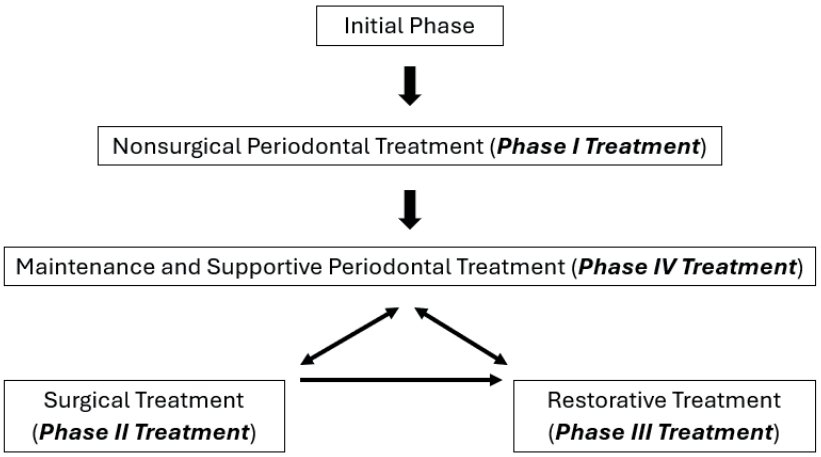


Figure 1. *Periodontal treatment planning.*

Initial Phase

Emergency Dental Treatment Procedures

Emergency dental treatment refers to conditions requiring urgent intervention due to pain, infection, trauma, or functional impairment. These procedures are typically classified under three main categories:

✓ **Dental and Periapical Emergencies**: This includes conditions such as acute pulpitis, periapical abscesses, and tooth fractures or trauma. These cases often present with sudden and severe pain and require prompt management.

✓ **Periodontal Emergencies**: Conditions such as necrotizing gingivitis (NG), periodontal abscesses, and pericoronitis fall into this category. These are generally accompanied by swelling, bleeding, halitosis, and systemic symptoms (e.g., fever, malaise).

✓ **Other Emergencies**: This includes soft tissue trauma, acute temporomandibular joint (TMJ) pain, complications related to orthodontic appliances, and postoperative bleeding.

Extraction of hopeless teeth and, when necessary, the planning of temporary prosthetic solutions are also carried out during the initial phase. Additionally, the impact of existing systemic diseases on periodontal disease prognosis and treatment, as well as the potential systemic implications of periodontal infections, should be thoroughly evaluated. (Newman, Takei, Klokkevold & Carranza, 2015)

Factors Influencing Initial Treatment Planning

Initial periodontal or dental treatment planning is a dynamic process that requires the consideration of various factors, including:

✓ **Uncertainty of Treatment Success**: The outcome of initial therapy is not always predictable. Factors such as the patient's biological response, systemic conditions, or local complications may influence the treatment results.

✓ **Patient Expectations and Communication Difficulties**: Patients may struggle to clearly express their complaints or expectations, complicating the adaptation of the treatment plan to their actual needs.

✓ **Unforeseen Complications During Treatment**: Unexpected situations may arise in various stages of treatment. For instance, the need for root canal therapy, especially in cases with complex anatomical variations like lateral canals, may complicate treatment and negatively affect outcomes.

Non-Surgical Periodontal Therapy (Phase I Treatment)

The primary goal of Phase I therapy is to reduce or completely eliminate gingival inflammation. Therefore, all local and systemic factors contributing to gingival inflammation must be addressed. (Newman, Takei, Klokkevold & Carranza, 2015)

Main procedures in this phase include:

✓ Ensuring effective plaque control and improving patient motivation through regular oral hygiene education,

✓ Mechanical debridement involving supragingival and subgingival scaling and root planing,

✓ Elimination or correction of restorative, prosthetic, or orthodontic factors contributing to plaque retention,

✓ Administration of local or systemic antimicrobial therapies when indicated,

✓ Management of carious lesions through temporary or permanent restorations,

✓ Endodontic treatment where necessary,

✓ Extraction of non-restorable teeth, especially in the presence of pain or infection,

✓ Evaluation and adjustment of occlusal relationships,

- ✓ Management of parafunctional habits such as bruxism and clenching,
- ✓ Orthodontic consultation and appropriate referrals,
- ✓ Planning of temporary splints and supportive prosthetic restorations,
- ✓ Nutritional counseling when required.

Evaluation of Phase I Therapy Outcomes

After completing non-surgical periodontal therapy, the effectiveness of the treatment protocol should be assessed using the following clinical parameters:

- ✓ Patient's compliance with oral hygiene and level of motivation,
- ✓ Depth of periodontal pockets and presence of residual inflammation,
- ✓ Amount of dental plaque, calculus, and inflammatory markers,
- ✓ Degree of tooth mobility,
- ✓ Presence of new or untreated carious lesions,
- ✓ Marginal adaptation, functional adequacy, and periodontal compatibility of existing restorations.

Surgical Therapy (Phase II Treatment)

Retention of teeth with questionable prognosis that may compromise periodontal health should be avoided. Treatment planning must focus on teeth with good, fair, or excellent prognosis.

Surgical Periodontal Therapy (Phase II Treatment)

Surgical periodontal therapy includes interventions aimed at correcting structural and functional defects in the periodontium, dentition, and masticatory system caused by periodontal disease. (Newman, Takei, Klokkevold & Carranza, 2015)

Procedures in this phase include:

- ✓ Regeneration of lost periodontal support tissues,
- ✓ Periodontal surgery for pre-prosthetic purposes,
- ✓ Placement of dental implants,
- ✓ Soft and hard tissue augmentation to meet esthetic requirements.

Restorative Therapy (Phase III Treatment)

Following the surgical phase, the following procedures are carried out to restore functional and periodontal integrity: (Newman, Takei, Klokkevold & Carranza, 2015)

✓ Completion of final restorations,

✓ Fabrication and placement of fixed or removable prostheses,

✓ Evaluation of restorations in terms of function, esthetics, and periodontal compatibility,

✓ Reassessment of periodontal health through comprehensive clinical examination.

Maintenance and Supportive Periodontal Therapy (Phase IV Treatment)

In patients who have undergone periodontal therapy, maintaining the achieved periodontal health over the long term is as crucial as disease elimination itself. Considering the potential for disease recurrence, Supportive Periodontal Therapy (SPT) must be implemented regularly and systematically. Accordingly, individualized recall intervals should be established based on the patient's periodontal condition, and periodic follow-ups must not be neglected. (Çağlayan, 2010; Azouni & Tarakji, 2014)

Key procedures in this phase include:

✓ Updating medical and dental history,

✓ Assessment and coordination of current oral, periodontal, peri-implant, and dental health,

✓ Detailed evaluation of pocket depth, attachment loss, bleeding, suppuration, and occlusal parameters,

✓ Reassessment and reinforcement of the patient's oral hygiene practices,

✓ Professional cleaning, root planing, and polishing,

✓ Re-evaluation of the need for surgical reintervention,

✓ Planning of local or systemic chemotherapeutic agents when indicated,

✓ Determination of individualized SPT intervals,

✓ Topical fluoride application for patients at risk of root sensitivity or car

✓ Identification and elimination of newly emerging risk factors and etiologic contributors.

Long-Term Perspective and Tooth Extraction Criteria in Periodontal Treatment Planning

Periodontal treatments are processes that require long-term planning and follow-up. In assessing the success of these treatments, the priority is not the number of teeth remaining in the mouth, but rather the long-term preservation of a healthy and functional dentition. The primary goal is to establish and maintain a healthy periodontium, avoiding excessive efforts to retain hopeless teeth. Furthermore, maintaining teeth with hopeless or questionable prognosis may lead to recurrent problems, compromising the health of adjacent teeth and causing loss of alveolar bone necessary for potential implant therapy. (Avila et al., 2009; Martin et al., 2014)

In treatment planning, careful evaluation should be made regarding teeth that are to be extracted, retained, or temporarily maintained. The criteria and timing for tooth extraction can be summarized as follows: (Newman, Takei, Klokkevold & Carranza, 2015)

✓ Non-functional teeth,

✓ Teeth with grade III mobility that cause pain during function,

✓ Teeth associated with recurrent acute abscesses during the course of treatment,

✓ Anterior teeth in the esthetic zone may be retained during the periodontal treatment process but should be re-evaluated before definitive prosthetic procedures,

✓ Extraction of hopeless teeth should be performed concurrently with periodontal surgical procedures involving adjacent teeth,

✓ Teeth that cause persistent pain or serve as a continuous source of infection - despite appearing clinically sound - should be extracted.

Communicating the Treatment Plan to Patients

Patient education during periodontal treatment is critical to the successful management of the disease. Therefore, clear and simple language should be used, avoiding complex and technical terminology. The following points should be considered when presenting the treatment plan to patients: (Newman, Takei, Klokkevold & Carranza, 2015)

✓ The etiology, progression, and treatment modalities of periodontal diseases should be explained in a simple and understandable manner.

✓ The diagnosis, established after thorough anamnesis and clinical examination, must be communicated clearly and in detail.

✓ A positive and supportive attitude should be adopted; during the initial consultation, focus should be placed on salvageable teeth rather than hopeless ones to avoid discouraging the patient. When discussing extractions, it should be emphasized that the goal is to preserve the health of the remaining dentition.

✓ Patients should be informed that various treatment options are available in stages and that they have the right to choose freely among them. Each option's benefits and limitations should be explained clearly, without applying pressure.

✓ It must be stated that leaving periodontal disease untreated is not advisable.

✓ The infectious nature of periodontal disease and its potential role as a focal infection contributing to systemic conditions (e.g., stroke, cardiovascular disease, pulmonary conditions, diabetes) should be highlighted. Improving periodontal health may significantly reduce such systemic risks.

✓ Patients should be informed that applying fixed or removable prostheses over unhealthy periodontal tissues has limited benefits and low long-term success rates.

✓ If left untreated, periodontal disease may negatively affect oral health, accelerate the loss of other teeth, and impair the overall prognosis of the dentition.

✓ The significance of healthy oral structures in terms of function, phonation, and esthetics, and their overall impact on general health, should be emphasized.

Objectives of Periodontal Therapy

Due to the regenerative capacity of periodontal tissues, it is possible to achieve desirable clinical outcomes following effective periodontal treatment. In cases of chronic inflammation, such as gingivitis, initial therapy can eliminate inflammation, allowing gingival tissues to return to their original structural and clinical appearance.

Successful periodontal therapy results in the resolution of pain and inflammation, reduction of periodontal pocket depths, arrest of hard and soft

tissue destruction, and decrease in abnormal tooth mobility. Treatment aims to establish an optimal occlusal relationship that allows patients to maintain oral function and hygiene. Moreover, recurrence of disease is prevented, physiological tooth contours are re-established, and previously damaged tissues are restored and stabilized to the extent possible. *(Figure 2)*

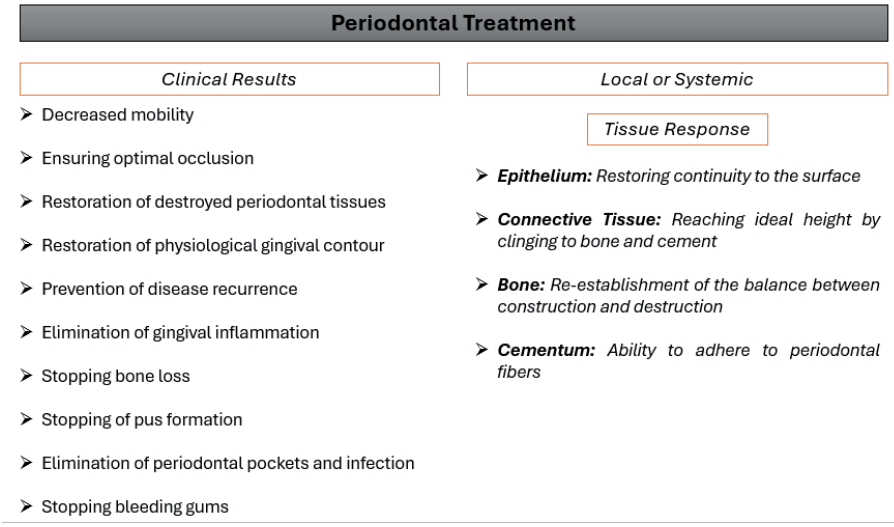


Figure 2. *Tissue response and clinical findings after periodontal treatment.*

Periodontal Treatment

Local Therapeutic Approach

The primary etiological factor of gingivitis and periodontitis is microbial dental plaque. Plaque accumulation may be triggered by factors such as calculus formation, overhanging restorations, occlusal discrepancies, functional deficiencies, or ill-fitting prosthetic margins, all of which should be targeted during local therapy. The goal of local treatment is the complete elimination of plaque accumulation and associated contributing factors.

Systemic Therapeutic Approach

Systemic therapy is not always required; however, it is employed in specific conditions. Its main indications include preventing systemic complications of acute infections, avoiding infective endocarditis - one of the most critical complications associated with bacteremia during treatment - and reducing infection risk in patients with immunosuppressive diseases, those on

immunosuppressive medications, or individuals with poorly controlled systemic diseases such as diabetes mellitus. (Şüküroğlu & Çağlayan, 2016)

Systemic antibiotic administration, in addition to initial periodontal therapy, is particularly utilized in patients with aggressive periodontitis. This approach aims to reduce the load of primary periodontal pathogens and to help restore the subgingival microbiota to a healthy state. Antibiotic therapy also helps control periodontopathogens residing on other oral surfaces, within tissues, fluids, epithelial cells, and connective tissue. When administered alongside initial therapy, systemic antibiotics contribute to a rapid decrease in subgingival microbial load. Furthermore, systemic antibiotic use aids in suppressing proteolytic species that may proliferate during the initial healing phase, thereby minimizing local tissue inflammation. As a result, a microenvironment is established that is compatible with host tissues, characterized by a low presence or absence of red complex bacteria, and conducive to the recolonization of health-associated microbial species. (Ferres, Figueiredo, Soares & Faveri, 2015)

In recent years, host response modulation - or host modulation therapy - has emerged as a novel medical approach in periodontal treatment. Host modulation refers to therapeutic strategies that aim to control the destructive effects of the host immune response triggered by subgingival periodontopathogens. The primary goal of such therapy is to re-establish the balance between destructive enzymes and their inhibitors or inflammatory mediators.

The application of host modulation in periodontology began with the use of the non-steroidal anti-inflammatory drug (NSAID) indomethacin in experimental periodontitis models by Nyman et al. in 1979. (Nyman, Schröeder & Lindhe, 1979) This study demonstrated that indomethacin reduced alveolar bone loss. Similarly, several studies have reported that ibuprofen, naproxen sodium, meclofenamate, and flurbiprofen were effective in halting the progression of periodontal disease. (Haffajee, Dibart, Kent & Socransky, 1979; Bichara et al., 1999) These agents primarily function by reducing levels of prostaglandin E2 (PGE2) and other arachidonic acid metabolites that are elevated in periodontal tissue destruction. (Alptekin, 2015) NSAIDs inhibit the enzymes lipoxygenase and cyclooxygenase, thereby reducing the production of prostaglandins, prostacyclins, thromboxanes, and leukotrienes. However, due to the recurrence of disease activity following discontinuation and the need for long-term administration to achieve lasting effects, their clinical use is limited. Moreover, the potential side effects of prolonged NSAID use - particularly on the gastrointestinal system, kidneys, and liver - have further restricted their applicability. (Shinwari et al., 2014)

Bisphosphonates are the most commonly used medications for treating systemic metabolic bone diseases, such as osteoporosis, Paget's disease, and

malignant hypercalcemia. These drugs inhibit osteoclastic activity, thereby preventing bone resorption, and they also accumulate in bone at high levels, inhibiting osteoblast formation and function. (Fleisch, 1997; Rogers et al., 2000) Alendronate, a member of the aminobisphosphonate group, has been shown to reduce bone loss in osteolytic lesions by suppressing osteoclast activity. Due to these characteristics, bisphosphonates have been considered potentially beneficial in the treatment of periodontitis. In animal studies, alendronate has been observed to increase bone density compared to placebo. (Weinreb et al., 1994) Clinical studies have also shown that local or systemic application of various bisphosphonates can positively influence the outcomes of both surgical and non-surgical periodontal treatments. (Jeffcoat, Cizza, Shih, Genco & Lombardi, 2007)

During the early 2000s, research on the effectiveness of bisphosphonates in periodontal therapy generally reported favorable results. However, the subsequent identification of bisphosphonate-related osteonecrosis of the jaw (BRONJ) raised concerns regarding their use as host modulation agents in the treatment of periodontal diseases. (Lane et al., 2005; Ruggiero et al., 2009) At present, the U.S. Food and Drug Administration (FDA) has approved the use of bisphosphonates exclusively for treating systemic bone loss. Consequently, their use in periodontitis as host modulation agents remains experimental and requires further investigation.

Factors Affecting Healing

Local Factors

Initial periodontal therapy includes ensuring adequate oral hygiene, cleaning of the tooth and root surfaces, and root planing, encompassing the removal of all soft and hard deposits. Following completion of wound healing, typically after a six-week follow-up period, the patient's oral hygiene status and systemic health are reassessed to determine whether surgical intervention is necessary. (Flores-de-Jacoby & Mengel, 1995)

Both local and systemic factors influence healing after periodontal treatment. Among the local factors, the complete removal of microbial dental plaque is paramount. Inadequate plaque removal, tissue trauma, excessive mechanical manipulation, presence of foreign bodies in the region, or repeated interventions without allowing sufficient healing time disrupt cellular activity and adversely affect wound healing. Removal of degenerated and necrotic tissues caused by the disease, stabilization of the area, and application of controlled pressure on the wound surface are factors that positively support healing. The greater the vascularization at the wound site, the higher the

cellular activity. Conversely, insufficient blood supply impairs tissue nutrition and may lead to necrosis.

Systemic Factors

Systemic conditions are critical determinants of periodontal wound healing. Diabetes mellitus, in particular, alters collagen synthesis, maturation, and turnover. Since collagen forms the main structural component of the periodontium, disturbances in collagen metabolism adversely affect wound healing. Additionally, diabetes-induced angiopathy impairs local circulation, while peripheral neuropathy and increased infection risk further delay healing. (Ryan, Carnu & Kamer, 2003) Consequently, uncontrolled diabetes mellitus is considered a significant systemic risk factor.

Metabolic and nutritional factors also play essential roles in the healing process. Disorders in carbohydrate and lipid metabolism hinder the functions of energy-demanding cells such as leukocytes and phagocytes, negatively impacting healing. (Knight et al., 2016) Nutritionally, vitamin C is critical for maintaining wound integrity; its deficiency adversely affects healing. (Van der Velden, Kuzmanova & Chapple, 2011) Deficiencies in B-complex vitamins - particularly pyridoxine, pantothenic acid, and folic acid - impair antibody production and some white blood cell functions, reducing resistance to infection. Vitamin K is involved in synthesizing prothrombin and clotting factors; its deficiency may result in bleeding in wounds. (Najeeb et al., 2016) Severe iron-deficiency anemia can secondarily impair healing by reducing oxygen transport. (Chakraborty et al., 2014)

Elevated plasma glucocorticoid levels suppress inflammatory responses, delaying wound healing and increasing susceptibility to infections. Age is another important factor; while children exhibit rapid wound healing, older adults experience delays in the inflammatory phase and reduced cellular activity. Age-related atherosclerotic changes and similar systemic conditions reduce blood circulation and slow the healing process. (Reynolds, 2014; Kanasi, Ayilavarapu & Jones, 2016)

Hormonal changes also influence healing; decreased estrogen during premenopausal and postmenopausal periods delays epithelial cell and fibroblast proliferation. (Reynolds, 2014) Additionally, stress negatively affects periodontal tissue healing by reducing leukocyte function and altering T1/T2 helper cell ratios, leading to immunosuppressive effects that delay recovery. (Boyapati & Wang, 2007; Warren et al., 2014)

Healing After Periodontal Treatment

Healing following periodontal therapy occurs in both soft and hard tissues. This process involves the removal of diseased and degenerated residual tissues. Although both repair and regeneration occur during healing, complete attachment gain is not always achieved.

Repair

Repair is a biological process in which continuity of the lost tissue is restored by the formation of new tissue that does not fully replicate the original function or structure. Before periodontal pocket formation, the gingival sulcus returns to its previous level on the root surface. In this case, the base of the pocket remains stable, and a normal sulcus is formed at that level. Healing occurs through scar tissue formation; there is no increase in bone level or true attachment gain. During repair, there is no regeneration or proliferation of epithelial or connective tissue cells in the region. The formation of a long junctional epithelium represents healing by repair. After root surface debridement, keratinocytes migrate from the sulcular epithelium into the periodontal pocket, resulting in this long junctional epithelium. (Chen & Jin, 2010) Although the attachment apparatus is restored, the original attachment and bone levels are not regained; hence, true regeneration does not occur. (Graber, Conrads, Wilharm & Lampert, 1999)

Reattachment

New attachment refers to the union of newly formed periodontal ligament fibers to a previously exposed root surface due to disease, along with the attachment of gingival epithelium. This involves the reattachment of connective tissue to a root surface that previously lacked viable periodontal ligament. (Nyman, Lindhe, Karring & Rylander, 1982) It is important to distinguish reattachment from new attachment. Reattachment occurs in areas where the root surface has not been exposed to the periodontal pocket environment. In other words, it is the reunion of connective tissue with a root surface covered by viable periodontal ligament. Healing of healthy tissues separated during surgery is an example of reattachment.

Regeneration

Regeneration is the reformation of the lost or damaged gingiva, cementum, periodontal ligament, and alveolar bone. Regenerative periodontal

therapy is based on restoring the structural and functional integrity of the periodontium. (Bosshardt & Sculean, 2009) This concept differs from new attachment, in which collagen fibers are deposited on a root surface devoid of periodontal ligament, as complete regeneration of the periodontium does not occur in new attachment.

Regeneration is a multifactorial mechanism involving the interaction of numerous cellular activities. For true periodontal regeneration to occur, undifferentiated connective tissue cells must differentiate into osteoblasts and cementoblasts; new connective tissue and epithelial attachments must form; and new cementum and bone must be generated on the root surface. (Polimeni, Xiropaidis & Wikesjö, 2006) Periodontal regeneration is a continuous physiological process, where new cells and tissues are formed, mature, and complete their life cycle. This is reflected in mitotic activity in gingival epithelium and connective tissue, new bone formation, and continuous cementum deposition. During regeneration, proliferation of periodontal ligament cells coronally results in new cementum and periodontal ligament formation. However, for this to occur, rapid migration of oral epithelial and connective tissue cells into the area must be prevented to avoid interference. (İvanovski, 2009) Various concepts and treatment methods have been developed to achieve this.

Criteria for Considering Periodontal Treatment as Regenerative

✓ Histological evidence in humans showing formation of new cementum, periodontal ligament, and bone coronally to the base of the defect.

✓ Controlled clinical trials in humans demonstrating significant improvements in probing attachment levels and bone height.

✓ Controlled histological studies in animals confirming the formation of new cementum, periodontal ligament, and bone.

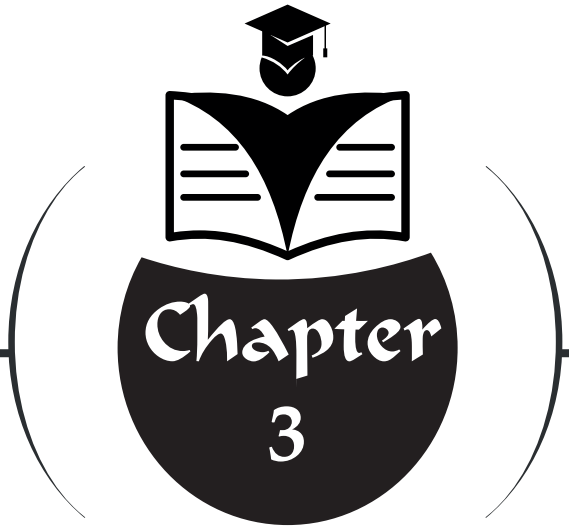
Well-controlled human histological studies are limited, and positive results observed in animal models are difficult to replicate exactly in humans. Currently, favorable clinical data obtained with techniques proven to have regenerative potential histologically are accepted as indirect evidence of regeneration. (Bosshardt & Sculean, 2009)

Conclusion

The primary goal of periodontal treatment is to enhance patients' quality of life by restoring a healthy dental and periodontal tissue system that ensures optimal aesthetics and function. Research has demonstrated significant

associations between periodontal disease and systemic conditions such as diabetes and arteriosclerosis. Furthermore, accumulating evidence supports the important role of periodontal therapy in the management and control of these systemic diseases.

Periodontal diseases can be effectively treated through both surgical and non-surgical approaches, leading to tissue repair or new attachment formation during the healing process. Currently, ongoing research aims to improve treatment outcomes further by developing novel techniques and biological approaches. However, even when successful healing is achieved, maintaining optimal oral hygiene remains a key factor for the long-term stability of treatment results.



MANAGEMENT OF ACUTE GINGIVAL INFECTIONS

Treatment Approach for Necrotizing Gingivitis (NG)

The management of necrotizing gingivitis (NG) involves alleviating acute clinical symptoms while simultaneously eliminating the underlying chronic periodontal pathologies. The treatment process cannot be considered complete if periodontal diseases or predisposing factors persist. While controlling acute symptoms is relatively straightforward, managing chronic periodontal conditions requires more comprehensive and long - term interventions.

Treatment Stages:

✓ **Acute Treatment Phase**: The primary goal at this stage is to control acute inflammation by removing necrotic tissues and microorganisms, thereby alleviating associated systemic symptoms such as fever and fatigue.

✓ **Chronic Treatment Phase**: This phase aims to eliminate predisposing factors and chronic periodontal conditions located in the acute lesion site or other regions of the oral cavity. Additionally, systemic conditions contributing to disease progression are addressed or controlled.

✓ **Surgical Intervention Phase**: At this stage, correction of periodontal defects through surgical methods is planned.

✓ **Maintenance Phase**: This phase includes regular follow-ups to prevent possible recurrences and to ensure long-term disease control.

A. First Appointment (Day 0)

Medical History

A detailed inquiry should be made regarding the patient's recent illnesses, lifestyle, dietary habits (especially vitamin and protein deficiencies), smoking and alcohol consumption, occupation, rest patterns, immunosuppressive status (e.g., risk of HIV/AIDS), harmful habits, and stress levels. Furthermore, the frequency of disease recurrence, its potential association with menstruation, physical fatigue, or psychological stress, and any previous treatments along with their characteristics should be recorded. (Özçelik & Haytaç, 2010; Haytaç & Özçelik, 2010)

Clinical Examination

General appearance, presence of oral dryness, skin lesions, systemic signs such as fever, and the status of submandibular and submental lymph nodes should be evaluated. The oral cavity should be thoroughly examined for lesions

specific to necrotizing gingivitis; localization and extent of the lesions, oral hygiene status, presence of pericoronal flaps, periodontal pockets, and local irritant factors (e.g., poor restorations, dental calculus, malocclusion) must be assessed. When necessary, a standardized form including all evaluation parameters may be used. Since probing NG lesions can cause severe pain, this procedure should be postponed until lesion healing. (Çağlayan, 2010)

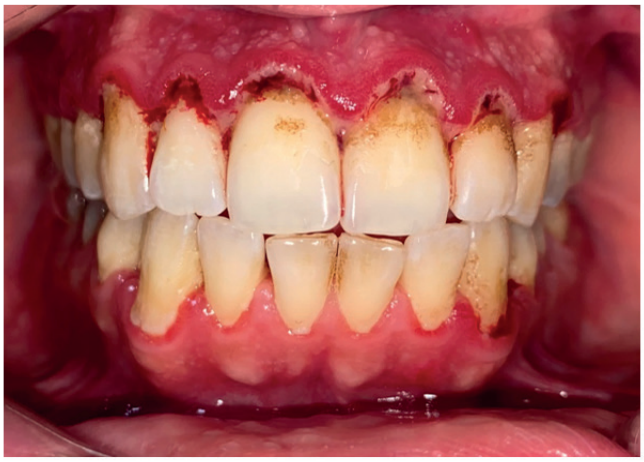


Figure 1. *Clinical appearance of a patient with necrotizing gingivitis (NG) presenting with gingival pain and halitosis complaints.*

Treatment

Initial treatment should be applied exclusively to areas exhibiting acute involvement. Following isolation and topical anesthesia, the pseudomembrane and debris layer on the lesion surface are carefully removed using cotton pellets soaked in a 3% hydrogen peroxide solution diluted 1:1 with sterile water. (Hakkı, 2010) Each pellet should be used on a single area only and then discarded. The same solution is then applied to the region as an irrigation. After oral cleansing, plaque removal may be performed using a soft toothbrush as tolerated by the patient. In cases where infection has penetrated deeper tissues, scaling and subgingival curettage are contraindicated at this stage due to the risk of bacteremia. To prevent exacerbation of acute symptoms, procedures such as tooth extraction and periodontal surgery should be postponed, generally for at least four weeks, until symptoms have completely resolved.

Recommendations

During the healing process of lesions, patients should avoid smoking, alcohol, caffeinated beverages, and spicy foods. It is recommended that patients rinse their mouths every two hours with a mixture prepared by diluting 3% hydrogen peroxide solution 1:1 with warm water, and also gargle twice daily with 0.12% chlorhexidine solution. Tooth brushing should be performed atraumatically using a new toothbrush without toothpaste. For pain management, nonsteroidal anti-inflammatory drugs (NSAIDs) may be administered. In moderate to severe NG cases accompanied by systemic symptoms such as fever, anorexia, lymphadenopathy, or malaise, bed rest and adequate fluid intake should be advised. Additionally, a 7 - day antibiotic regimen consisting of metronidazole 250 mg three times daily or a penicillin derivative with low hepatotoxicity should be initiated. Antibiotic therapy may not be necessary for cases without systemic complications and with limited ulcerations. Patients must be thoroughly informed that pain resolution does not indicate completion of treatment; the underlying chronic periodontal disease persists, and if untreated, acute symptoms may recur.

B. Second Appointment (Day 1 - 2)

Clinical Evaluation

During this session, a reduction in both local and systemic symptoms is observed. The patient's pain complaints have decreased or become intermittent. Although erythema persists on the affected gingival margins, the superficial pseudomembrane seen during the first appointment is no longer present.

Recommendations

The instructions given during the first appointment remain valid. With symptom relief, it is recommended that patients adopt dietary habits that support the immune system. (Çağlayan, 2010)

C. Third Appointment (Day 7)

Clinical Evaluation

Erythema is still present in the affected area, and the gingiva remains tender to palpation. However, the patient's subjective complaints have largely resolved.

Treatment

If clinically indicated, scaling and root planing procedures may be initiated or continued if already started.

Recommendations

From this stage onward, it is advised that patients transition to routine oral hygiene practices supported by adjunctive aids (e.g., interdental brushes). Additionally, counseling regarding behavioral factors such as nutritional habits, tobacco use, tea and coffee consumption, and existing psychological stressors should be provided. Multidisciplinary support may be sought if necessary. Use of hydrogen peroxide (H_2O_2) mouthwash should be discontinued, while rinsing with 0.12% chlorhexidine solution twice daily is recommended for an additional 2 - 3 weeks.

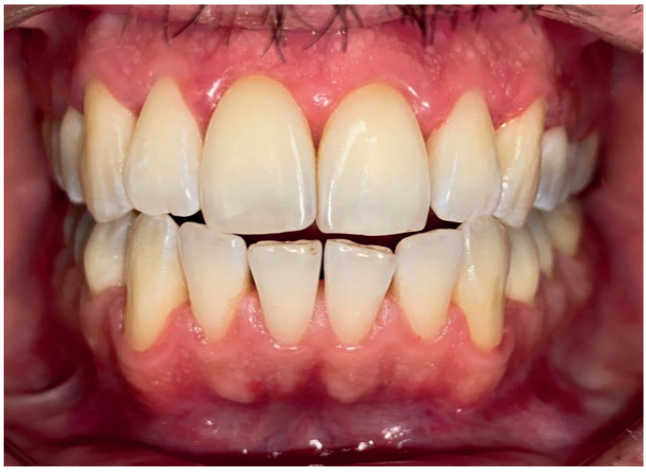


Figure 2. *Clinical appearance at the end of treatment.*

Follow-up and Long-Term Management

To prevent disease recurrence and ensure the long-term maintenance of periodontal health, comprehensive treatment of the underlying chronic periodontal conditions should be initiated. In this context, the elimination of all local irritants, predisposing factors, and pericoronal flaps must be targeted, and relevant treatment sessions planned accordingly. During the intervals between sessions, the patient's oral hygiene habits, general systemic condition,

and psychosocial risk factors should be regularly assessed. Referrals to appropriate healthcare disciplines should be made when necessary. A healing period of at least one month should be allowed before performing surgical periodontal interventions.

Clinical Healing Observations

✓ At the first appointment, removal of the superficial pseudomembrane reveals an underlying hemorrhagic, red, crater-like gingival surface.

✓ At the second appointment, erythema at the crater margins diminishes; however, the gingival surface still appears shiny and edematous.

✓ By the third appointment, gingival tissues begin to regain their normal contour and color, indicating a healthy progression of the healing process.

D. Surgical Treatment Phase

In cases exhibiting severe gingival necrosis, gingival contour typically returns to normal following the healing period. However, complete histological and morphological healing of the gingiva may require weeks to months. When interdental bone loss, irregular tooth alignment, or papilla loss is present, healing often results in a "shelf-like" gingival morphology. This condition poses clinical challenges not only in terms of aesthetics but also due to increased plaque retention and recurrent gingival inflammation.

Newman et al. emphasize that effective plaque control by the patient plays a fundamental role in maintaining and reshaping gingival contour, especially in areas of irregular tooth alignment. (Newman, Takei, Klokkevold, & Carranza, 2012) Accordingly, consistent and disciplined personal oral hygiene practices are critically important. Mechanical hygiene methods such as tooth brushing, dental flossing, oral irrigators, and finger massage, performed regularly for at least one year, support gingival morphology improvement and reduce plaque accumulation, thereby lowering recurrence risk.

In rare cases where these measures prove insufficient, surgical procedures including gingivectomy, gingivoplasty, flap operations, or reconstructive surgery may be considered to restore gingival morphology. (Newman, Takei, Klokkevold, & Carranza, 2012) Nevertheless, in patients with necrotizing gingivitis (NG), it is recommended that all conservative treatment options be thoroughly evaluated before proceeding with surgical interventions, which should only be performed when absolutely necessary. (Çağlayan, 2010)

E. Maintenance Phase

Following the acute and chronic treatment phases, plaque accumulation may persist, particularly in areas where crater formation has developed. It has been reported that, in some cases, plaque accumulation cannot be entirely prevented despite surgical intervention. Persistent plaque buildup not only predisposes to chronic inflammatory periodontal diseases but also plays a significant role in the recurrence of necrotizing periodontal diseases. (Klokkevold & Carranza, 2012) Therefore, regular follow-up and ongoing professional care are of paramount importance. During the maintenance period, plaque control, oral hygiene habits, tobacco use, systemic health status, nutritional patterns, and psychosocial factors should be periodically reviewed, and individualized support provided to the patient when necessary. (Çağlayan, 2010)

Cases Unresponsive to Treatment and Recurrences

The majority of necrotizing gingivitis (NG) cases can be successfully managed with optimal personal care and adequate local treatment. However, in some cases, lesions may recur and symptoms may persist despite treatment. In such instances, the patient should be re-evaluated systematically by addressing the following questions:

✓ **Was the local treatment adequately applied?**

NG may recur if only acute symptoms are managed while the underlying chronic periodontal disease remains untreated. Therefore, all local predisposing factors should be reviewed and eliminated.

✓ **Is patient compliance and motivation sufficient?**

Poor plaque control, smoking, psychological stress, and inadequate nutrition may contribute to NG recurrence. These factors should be thoroughly assessed.

✓ **Is the lesion truly NG?**

Several systemic diseases or dermatological conditions may present with NG-like appearances. Therefore, skin lesions and accompanying systemic symptoms must be carefully examined, and biopsy should be performed if necessary for differential diagnosis.

✓ **Is there a systemic disease causing immunosuppression?**

HIV infection, in particular, can be associated with NG and necrotizing periodontitis (NP). Therefore, the patient should be reassessed for systemic immune deficiencies, primarily HIV, and appropriate consultations and tests should be conducted.

The Role of Medications in Treatment

Systemic and topical medications in the treatment of necrotizing gingivitis (NG) serve only as adjuncts and cannot achieve successful outcomes when used alone. Many mild NG cases can be managed effectively with topical agents and mechanical debridement without the need for systemic drugs.

Due to the predominantly anaerobic nature of the microbiota in NG, oxygen-releasing agents are recommended. 3% hydrogen peroxide can be used both for mechanical debridement and as a mouth rinse during the acute phase of treatment. It has been demonstrated that hydrogen peroxide releases free oxygen, reducing the anaerobic flora, and its efficacy increases when combined with mechanical cleaning. (Wennstrom & Lindhe, 1979; MacPhee & Cowley, 1981) Furthermore, clinical and microbiological evaluations over a 10-day period have shown that oxygen-supported therapy accelerates microorganism elimination and decreases periodontal destruction. (Gaggl, Rainer, Grund & Chiari, 2006) However, prolonged use of hydrogen peroxide may lead to adverse effects such as hyperkeratinization and "hairy tongue" on the dorsal surface of the tongue.

The use of caustic agents such as phenol, silver nitrate, chromic acid, and potassium bichromate is contraindicated in NG treatment. Although these substances may temporarily relieve pain, they damage the young cells necessary for healing, thereby delaying recovery. If mechanical brushing is not possible during the acute phase due to intense pain, rinsing with 0.12% chlorhexidine solution is recommended to reduce plaque accumulation. However, chlorhexidine may be inactivated by exudate, necrotic tissues, and bacterial metabolites, limiting its penetration into subgingival areas. (Gjermo, 1974) Therefore, for optimal results, chlorhexidine should be used as an adjunct to mechanical therapy.

In cases with limited clinical response despite mechanical debridement and hydrogen peroxide application, systemic antibiotics should be added, especially in moderate to severe NG accompanied by systemic symptoms such as fever, malaise, anorexia, and lymphadenopathy. These antibiotics aim to eradicate the anaerobic bacterial flora responsible for NG and to reduce systemic manifestations. Due to the penetration of the causative microorganisms into the tissues and the insufficient tissue concentration of topical agents, systemic administration of antibiotics is necessary.

Metronidazole at a dose of 250 mg three times daily is particularly effective against spirochetes and is recommended as the first-line treatment for necrotizing periodontal diseases. (Loesche, Syed, Laughon & Stoll, 1982) Penicillin and tetracycline group antibiotics may be used as alternatives. However, the use of systemic antibiotics alone without mechanical debridement

may lead to rapid symptom relapse. Additionally, it has been suggested that antibiotics are less effective against the NG-specific microbiota compared to hydrogen peroxide and chlorhexidine. (Çağlayan & Güncü, 2010)

Treatment of Primary Herpetic Gingivostomatitis (PHG)

Primary herpetic gingivostomatitis typically lasts 7 to 12 days and usually resolves spontaneously without scarring. Early diagnosis and prompt initiation of antiviral therapy are crucial for effective management. While previous treatment approaches mainly focused on supportive care to alleviate pain, the development of antiviral agents has significantly changed treatment standards.

In a randomized, double-blind, placebo - controlled study, administration of acyclovir suspension at a dose of 15 mg/kg five times daily for 7 days resulted in a significant improvement in the disease course without serious adverse effects. (Amir, Harel, Smetana, & Varsano, 1997) Acyclovir notably reduced the duration of fever, the formation of new extraoral lesions, and the persistence of difficulty in chewing.

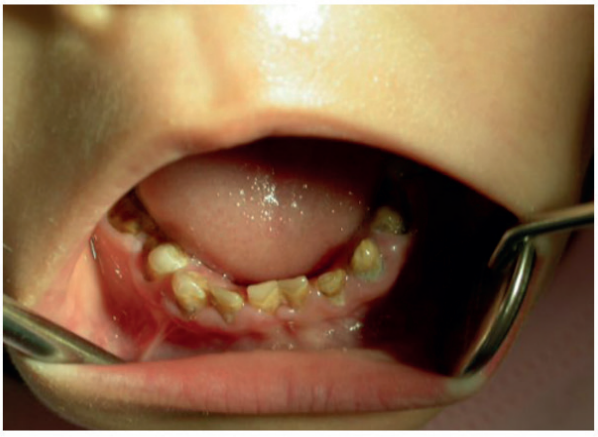


Figure 3. *Gingival ulcerations in a case of primary herpetic gingivostomatitis. (PHG) (YILDIRIM, HAŞTAR, YILMAZ, and AYDIN, 2006)*

If primary herpetic gingivostomatitis (PHG) is diagnosed within the first three days of onset, acyclovir suspension at the recommended dose can be prescribed. However, if diagnosis occurs after the third day, the efficacy of antiviral treatment is limited. In such cases, palliative care focusing on the removal of plaque and necrotic debris is applied. Systemic non-steroidal anti-

inflammatory drugs (NSAIDs) may be used to reduce fever and pain.

During the early phase of PHG, adequate nutrition and symptom relief are supported by increased fluid intake, topical anesthetics and analgesics, or vitamin supplementation. Periodontal treatment should be postponed until acute symptoms subside. To reduce the risk of opportunistic infections and ulceration, local or systemic antibiotics may be necessary in certain cases. If symptoms do not improve within two weeks, consultation with a medical physician is recommended. (Langlais, Miller, & Nield-Gehrig, 1998)

Patients should be informed about the contagious nature of the disease through contact with vesicular lesions and the necessary precautions. Particularly in infants, who frequently bring their hands to the mouth, close contact such as kissing and hand-holding should be avoided. It is also important to note that seronegative clinicians who come into contact with lesions may develop herpetic whitlow on their fingers. (Synder et al., 1969: Regezi et al., 1989)

Treatment of Acute Pericoronitis

The treatment of pericoronitis should be planned according to the severity of inflammation, presence of systemic complications, and the likelihood of retaining the affected tooth in the oral cavity. In patients under 20 years old, if there is no obstruction to tooth eruption, the natural eruption process may continue, allowing the inflammation to resolve spontaneously.

The prognosis of the tooth with pericoronitis is the primary consideration in treatment planning. If the tooth is to be retained, surgical treatment of the pericoronal flap should be performed after controlling the acute symptoms. If extraction is necessary, it can be carried out using surgical or nonsurgical methods. If these interventions are not performed once the tooth becomes asymptomatic, there is a high risk of recurrence of acute pericoronitis.

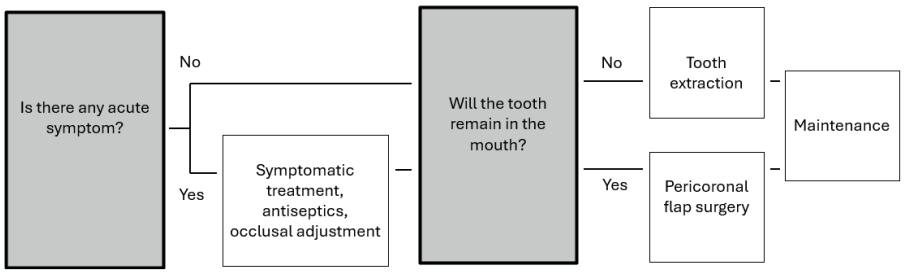


Figure 4. *Recommended treatment approach for acute pericoronitis management.*

Acute symptoms can be alleviated by irrigating the affected area with warm water or saline solution to remove debris and exudate, followed by gentle retraction of the pericoronal flap from the tooth using a small elevator, and cleansing the area with antiseptic agents. Although some clinicians emphasize the importance of the type of antiseptic used, it is generally considered that no critical difference exists in this regard. The tooth opposing the pericoronal flap should be carefully evaluated for occlusal contact. To reduce pain, removal of the soft tissue contacting the opposing tooth, smoothing of the tooth surface, or, if necessary, extraction of the opposing tooth may be considered. In severe cases, particularly when lymphadenopathy is present or widespread microbial infiltration of tissues is suspected, systemic antibiotic therapy is indicated. Penicillin derivatives or clindamycin are the preferred first-line antibiotics. Additionally, if swelling and fluctuation are observed in the gingival flap, an incision may be necessary to relieve pressure and provide drainage.

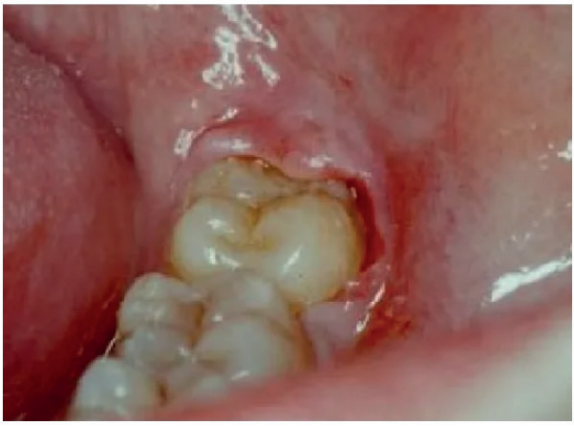
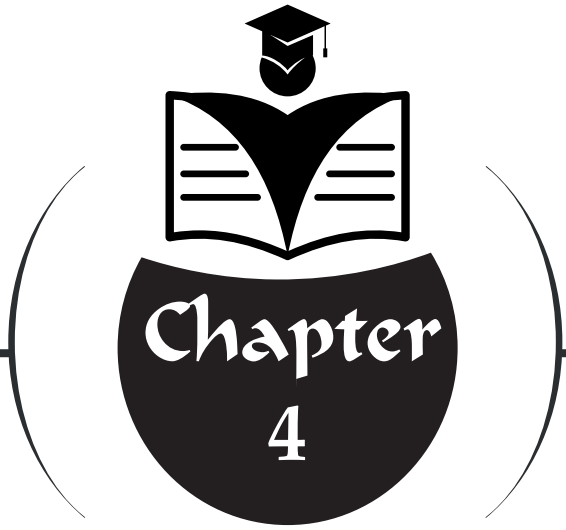


Figure 5. *Pericoronitis (Dr. Haroon, 2024, Pericoronitis: Causes, Symptoms, Effective Treatments, And Prevention Tips For Pain-Free Oral Health)*

The decision to retain or extract the tooth is based on the likelihood of the tooth erupting into a functional position and the presence of factors facilitating pericoronitis. In cases where third molars remain impacted, bone loss on the distal surface of the adjacent second molar is a significant potential problem. (Ash and Costich, 1962) The risk of such complications increases when third molars are extracted after root formation is complete or when the patient is an adult. Therefore, early removal of partially or fully impacted third molars during their developmental phase is generally preferred. During extraction, it is crucial to apply force in the correct direction and magnitude, perform tooth sectioning with a bur carefully, and avoid undue stress on the

bone distal to the second molar during elevator use. This minimizes stress on the surrounding bone and helps prevent resorption of the adjacent septum. It is known that approximately 25 - 30% of impacted lower molars are extracted due to pericoronitis or recurrent pericoronitis. (von Wowern and Nielsen, 1989)

Provided no postoperative complications occur, pericoronal inflammation typically resolves spontaneously. To reduce the risk of complications, it is beneficial to suture the tissues surrounding the extraction socket without tension. For this purpose, the tissue located mesially on the occlusal side of the tooth can be mobilized and approximated over the socket before extraction. If the tooth is planned to be retained in the oral cavity, the pericoronal flap should be surgically removed. This procedure requires removal of tissue not only from the distal surface of the tooth but also from the occlusal surface. Incising only the occlusal part of the flap may create a pocket prone to recurrent acute pericoronal inflammation on the distal aspect. Leaving the surgical area clean and accessible is important for effective healing. During the recovery phase, patients should be thoroughly informed about the importance of long - term maintenance and care.



CONSCIOUS SEDATION IN PERIODONTAL SURGICAL PROCEDURES

In contemporary dental practice, the concepts of pain and anxiety control, along with conscious sedation, hold significant importance. In conscious sedation procedures, it is essential to preserve the patient's level of consciousness and protective reflexes, while ensuring they remain responsive to verbal stimuli. Although local anesthesia alone is sufficient for most dental treatments and oral surgical procedures, it may be inadequate in patients exhibiting intense fear, anxiety, or reluctance, making operative pain control more challenging. In such cases, the use of premedication - namely, conscious sedation techniques - is considered an appropriate approach. Various methods exist for the administration of sedative agents, each with its own advantages and limitations.

Atropine was first used for premedication purposes in 1880. This approach provides a more comfortable and less stressful operating environment for both the clinician and the patient. In pediatric dental procedures, resistance to treatment is frequently observed due to emotional and physical factors. (Album, 1957) The incidence of complications during dental interventions is notable in both adult and pediatric populations. In children, these issues are often exacerbated by factors such as young age, lack of emotional maturity, and the presence of mental and/or physical disabilities. In this context, Album (1957) suggested that "with appropriate pharmacological intervention, any procedure can become feasible; thereby, doubts and physical trauma are minimized, and the patient is placed in a more relaxed state."

Dental procedures in very young children often present significant challenges. As a result, hospitalization under general anesthesia may be required, or treatment may need to be postponed until the child reaches a more appropriate age. However, if postponing treatment is not desirable, performing dental interventions under sedation may be a preferable alternative. In patients with physical and emotional difficulties, it is possible to reduce existing stress through premedication, thereby allowing dental procedures to be performed under local anesthesia. To minimize oral secretions and alleviate the patient's anxiety, it is recommended that premedication be administered approximately 30 - 45 minutes prior to local anesthesia. (Prichard, 1972)

Conscious Sedation

In dentistry, the majority of patients can comply with treatment through the use of local anesthesia combined with effective behavior management. However, in emotionally or physically compromised pediatric and adult patients, these approaches may prove insufficient, necessitating the application of additional techniques, including conscious sedation. Particularly in anxious and phobic individuals, completing dental procedures using only

local anesthesia and behavioral guidance methods can be challenging. In such cases, the use of sedation techniques is recommended. (Ceravolo et al., 1980) Conscious sedation is considered a fundamental component of pain and anxiety management and can significantly reduce the need for general anesthesia in dental treatments. (Ceravolo et al., 1980) The increasing use of sedation techniques by dentists today indicates that this method has become an integral part of clinical practice.

Conscious sedation has long been employed in both medicine and dentistry alongside local anesthetic procedures. (Ceravolo et al., 1980) Monheim was the first to apply this technique during World War II in the Philippines. In the past, many surgical procedures could only be performed under general anesthesia in hospital settings. Today, however, thanks to intravenous (IV) conscious sedation, such procedures can be carried out safely in dental clinics and outpatient settings. This shift offers significant advantages in terms of both cost-effectiveness and practicality for both patients and clinicians.

Conscious sedation is defined as a clinical state in which the patient's level of consciousness is minimally depressed through pharmacological and/or non-pharmacological methods, while airway patency is maintained, protective reflexes are preserved, and the patient remains responsive to verbal or physical stimuli. In other words, this technique refers to a sedated state achieved by combining sedative and analgesic agents to reduce anxiety during medical or dental procedures. (Reves et al., 2009; Sherwood, Williams & Prough, 2012) One of the key advantages of conscious sedation is that patients can quickly recover from its effects and return to their normal daily activities shortly after the procedure.

Indications for Conscious Sedation

General anesthesia is not always a practical or appropriate option for outpatients requiring minor surgical interventions. (Cohen, 1979) As a result, the use of various anxiolytic and sedative agents as alternatives to general anesthesia has become increasingly widespread. Studies conducted in the United Kingdom have demonstrated that conscious sedation techniques used in dental procedures possess a high safety profile. In particular, titrated intravenous (IV) midazolam and titrated inhaled nitrous oxide/oxygen combinations are commonly employed. These techniques, when combined with effective local anesthesia, have been reported to serve as suitable alternatives to general anesthesia. In both sedation and anesthesia applications, it is of significant ethical and clinical importance to share the potential risks and benefits of each technique with the patient. Although conscious sedation is generally regarded as a safe, effective, and cost-efficient method, general

anesthesia is still indicated for certain patient populations and specific dental or surgical procedures. (Shaw, Kumar, & Dodds, 2011)

IV sedative-hypnotic agents are widely used in oral surgery to enhance patient comfort, provide a favorable working environment for the surgeon, and prevent intraoperative complications. (Sarasin, Ghoneim, & Block, 1996) Diazepam and midazolam are among the most frequently used agents; however, in recent years, propofol has emerged as a more current and effective alternative due to its rapid onset, short duration of action, fast elimination, and low excitatory side effects. (Ebenezer et al., 2013) In the context of periodontal surgeries, Prichard (1970) opposed the use of general anesthesia and instead recommended the intramuscular (IM) administration of sedative agents. Tibbetts (2004) supported the use of various sedative drugs and their combinations in periodontal procedures. The primary reasons patients tend to avoid periodontal treatment include fear and anxiety related to surgical interventions, anticipated discomfort during or after the procedure, time constraints, and certain systemic risk factors. (Cohen, 1979)

Certain conditions - such as Parkinson's disease, mental retardation, and a strong gag reflex - may render dental procedures under local anesthesia unfeasible. Moreover, in patients with hematological disorders requiring blood transfusion prior to surgery, the procedure must be completed in a single session. In such cases, periodontal treatments should be performed under deep sedation or general anesthesia.

In addition to the aforementioned reasons, conscious sedation is considered a safe and effective method in surgical and diagnostic procedures. According to Tibbetts (2004), conscious sedation is indicated for:

- ✓ The treatment of anxious and phobic patients
- ✓ The comfortable execution of procedures that may be stressful for the patient
- ✓ Establishing an appropriate oral surgical environment
- ✓ Situations where general anesthesia should be avoided
- ✓ Breast biopsy
- ✓ Dental prosthetic and oral reconstructive surgeries
- ✓ Minor foot surgery
- ✓ Minor skin surgery
- ✓ Plastic and reconstructive surgeries
- ✓ Diagnostic and therapeutic procedures of the gastrointestinal

and urinary systems, such as colonoscopy, bronchoscopy, endoscopy, and cystoscopy.

Depth and Limits of Conscious Sedation

Conscious sedation is a technique involving the controlled use of pharmacological agents that induce central nervous system (CNS) depression to facilitate treatment procedures. (Tibbetts, 2014) This level of sedation is adjusted in a way that does not eliminate the patient's consciousness entirely but allows them to maintain verbal communication and preserve protective reflexes. Throughout the procedure, verbal contact with the patient is maintained, and the patient is expected to respond appropriately to environmental stimuli. (Tibbetts, 2014)

Sedative drugs and techniques used in dental treatments must be carefully selected and administered in a manner that does not lead to loss of consciousness. The level of sedation should be kept within defined safe limits to ensure both patient comfort and the preservation of vital functions, such as airway reflexes. Situations in which the patient cannot respond to verbal stimuli or is unable to maintain airway patency independently exceed the boundaries of conscious sedation and fall under the domain of general anesthesia. In such cases, the administration of anesthesia must be carried out solely by anesthesia professionals with appropriate training and expertise in this area.

Precautions Before and After Conscious Sedation

For the safe and effective administration of conscious sedation techniques in dental and oral surgical procedures, a comprehensive patient evaluation, accurate treatment planning, thorough pharmacological knowledge, and availability of complete sedation equipment are essential. Additionally, familiarity with standard and alternative sedation techniques, management of medically at-risk patients, prevention of sedation-related complications, and prompt intervention in the event of such complications are of great importance. (Shaw, Kumar, & Dodds, 2011)

To minimize the risk of complications, the following patient information must be recorded by the physician or nurse prior to sedation:

- ✓ Pregnancy status
- ✓ Prescription and over-the-counter medications, including names
- ✓ Drug allergies or existing medical conditions

- ✓ Results of blood and urine tests
- ✓ Smoking status

All these data must be meticulously evaluated in conjunction with the patient's medical history. (Reves, Glass, & Lubarsky, 2009; Sherwood, Williams, & Prough, 2012)

In patients considered for sedation, detailed documentation of systemic diseases - especially cardiovascular and respiratory disorders, hepatic and renal dysfunction, pregnancy, and psychiatric conditions - is necessary. Blood pressure measurement is also a critical parameter in the pre-sedation assessment. All medications used by the patient must be recorded, with particular attention to the presence of central nervous system (CNS) depressants. Allergies or absolute contraindications to sedative agents must be ruled out, while relative contraindications identified in the medical history should be carefully considered. (Sherwood, Williams, & Prough, 2012)

Prior to the procedure, patients should be reminded to abstain from food and fluids after midnight and to avoid alcohol consumption on the day before and the day of sedation. Sedative medications should be taken orally as prescribed by the physician, accompanied by an adequate amount of water. Post-sedation, patients may experience side effects such as drowsiness, headache, and gastrointestinal discomfort. During recovery, oxygen saturation and blood pressure should be monitored using pulse oximetry and measured at 15-minute intervals, respectively. Patients can typically be discharged 1 to 2 hours following sedation. (Sherwood, Williams, & Prough, 2012)

Patients should be advised not to drive, consume alcohol, make legal decisions, or use medications or herbal supplements without medical supervision for at least the first 24 hours after sedation. Furthermore, strict adherence to the physician's instructions regarding surgical wound care must be emphasized. (Sherwood, Williams, & Prough, 2012)

Assessment of Patients' Physical Status

The appropriate selection of dental patients is crucial in the decision - making process regarding sedation. When sedation is deemed necessary, a comprehensive evaluation of both the physical and psychological conditions of the patient must be conducted. (Jackson & Johnson, 2002) This is particularly important as most dental diseases are non-life-threatening and generally elective in nature. For medically high-risk patients (ASA III and above), elective dental treatments should be postponed until the patient's health status is stabilized before sedation is administered. Furthermore, sedation

in medically compromised patients must be performed by experienced personnel.

In conclusion, conscious sedation is considered a safe procedure only under conditions where adequate preparations have been made in advance, and all necessary precautions are taken to manage potential emergencies during sedation. Understanding the patient's physical status is a fundamental prerequisite for selecting the appropriate sedation technique. The American Society of Anesthesiologists (ASA) classification system is widely employed for this assessment. (Tibbetts, 2004) The ASA classification is a universally accepted system used to determine the physical status of patients undergoing both conscious sedation and general anesthesia. Each patient should be evaluated individually. (Tibbetts, 2004) Conscious sedation is generally suitable for patients classified as ASA I or ASA II. Patients in ASA III require special medical evaluation and preparation, while ASA IV patients are considered unsuitable candidates for conscious sedation in the outpatient dental setting. (Tibbetts, 2004)

ASA I	Systemically healthy individuals without any underlying medical conditions
ASA II	Patients with mild systemic disease
ASA III	Patients with severe systemic disease that limits activity but is not incapacitating
ASA IV	Patients with severe systemic disease that is a constant threat to life
ASA V	Critically ill patients who are not expected to survive more than 24 hours with or without surgical intervention

Table 1. *Classification of patients according to general health and physical condition according to ASA classification.*

Conscious sedation is generally appropriate only for patients classified as ASA I and II in general practice and dental clinics. Patients categorized as ASA IV and ASA V are typically under hospital care or bedridden, and interventions are performed only when urgent dental treatment is required. ASA III patients, on the other hand, should be managed exclusively in hospitals or sedation centers where full support is available and by teams with advanced experience.

Selection of Sedative Agents

Before discussing premedication techniques, it is useful to provide a general overview of the commonly used drugs in conscious sedation. The most frequently preferred drugs in conscious sedation applications are reported to be diazepam, midazolam, and propofol. (Sherwood, Williams, & Prough, 2012) Historically, the drugs used in conscious sedation can be listed as follows: (Tibbetts, 2004)

1.Inhalation Conscious Sedation with Nitrous Oxide (N_2O)

Nitrous oxide is an inert, colorless inorganic gas in the body. Among the currently used sedative gases, it possesses the lowest potency. N_2O can be safely used alone or in combination with oxygen without special safety precautions due to its non-flammability. At concentrations of 10 - 15%, mild sedation, numbness in the extremities, and tingling sensations are observed; sedation increases at 35 - 40%, with an analgesic effect approximately equivalent to 15 mg of morphine. The ideal concentration for conscious sedation is recommended to be above 50%. The effects of nitrous oxide administration begin within less than one minute and reach their peak within 3 - 5 minutes. This agent generally maintains cardiovascular and respiratory functions within normal limits.

2.Barbiturates

Short-acting barbiturates are among the most extensively studied sedative agents in oral surgery. Barbiturates were one of the first groups of drugs used for anxiety management. (Loughlin et al., 1979) Before the development of benzodiazepines, they were widely prescribed. Pentobarbital sodium and secobarbital sodium are barbiturates used in oral surgery that exhibit onset of action within 20 - 25 minutes and have a duration of effect of 3 - 4 hours, which is suitable for most periodontal treatments. However, these drugs have long half-lives; for example, secobarbital ranges from 20 to 28 hours, and nembutal from 21 to 42 hours. This prolonged half-life can cause lingering effects and irritability in patients.

Although barbiturates are not effective in pain control, they are currently used as alternatives in patients allergic or reactive to benzodiazepines. Their pharmacological effects are less specific and less potent compared to benzodiazepines. Barbiturates act as central nervous system depressants; at therapeutic doses, they reduce anxiety, suppress mental activity, and induce mental drowsiness. Higher doses depress the medulla, potentially causing

respiratory depression. Uncontrolled respiratory depression may lead to cardiovascular depression, coma, and even death. Therapeutic doses of barbiturates do not provide analgesia during conscious sedation, thus patients remain sensitive to pain and painful stimuli. Side effects may include agitation, nausea, vomiting, hiccups, anti-analgesic effects, and excessive postoperative drowsiness. (Malamed, 2003)

Pharmacologically, barbiturates have a narrower therapeutic safety margin compared to benzodiazepines. Dose-dependent risk of respiratory depression, drug interactions, and a lower safety margin are significant disadvantages of barbiturates. Historically, barbiturates have also been subject to abuse.

Contraindications for Barbiturate Use Include:

- ✓ Hypersensitivity
- ✓ Uncontrolled pain
- ✓ Respiratory diseases, obstruction, or dyspnea
- ✓ Latent or overt history of porphyria (personal or familial)
- ✓ Severe hepatic dysfunction
- ✓ Pregnancy and lactation (due to potential risks to fetus and infant)

In dentistry, the barbiturates most commonly used for conscious sedation are nembutal and secobarbital.

3. Psychosedative Drugs (Tranquilizers)

Benzodiazepines are the most commonly used psychosedative agents in conscious sedation. Although many benzodiazepines have been developed over time, two important drugs frequently preferred in dentistry and general medicine are valium (diazepam) and midazolam.

a. Diazepam (Valium)

Diazepam has long been used in the treatment of dental patients and is considered an effective short-acting tranquilizer. When administered intravenously (IV), it provides well - controlled sedation and sufficient relaxation for periodontal surgical procedures lasting over 1.5 hours. (Ruggerio, 1975) Clinical experience shows that diazepam has a wide therapeutic safety margin and can be safely used routinely in oral surgery in combination with local anesthesia. (Ebenezer, 2013)

Diazepam is a drug that can be titrated over a wide spectrum ranging from mild sedation to hypnosis. It offers advantages such as rapid onset of drowsiness, smooth sedation, effective amnesia, and quick recovery time. (Blackwood, 1969) It has minimal effects on the cardiovascular system and does not cause respiratory depression except at high doses. However, diazepam also has notable disadvantages, including injection site pain (reported in 30 - 80% of cases), risk of post-injection thrombophlebitis, long half-life, and weak analgesic effects. (Wood & Sheik, 1986; Mitchell, 1980; Aun, Flynn & Richards, 1984) Due to its amnestic effects, IV diazepam was first used in general dental procedures by French dentist Davidan in 1965 and subsequently became widely preferred in oral surgery and pediatric dentistry.

Chemically, diazepam is a benzodiazepine with pharmacological tranquilizing effects, similar to chlordiazepoxide. It is available for IV use in a 5 mg/ml concentration as a slightly yellowish, viscous solution. Diazepam exhibits strong sedative, amnestic, and muscle-relaxant properties by depressing the limbic system of the cortex. (Verrill, 1972) Minimal effects on respiratory or cardiovascular stability have been reported in healthy individuals even at high doses. (Ebenezer, 2013) Diazepam is an irritant to veins and can cause pain during injection. To reduce thrombophlebitis risk and venous intima irritation, dilution of the drug is recommended. (Tibbetts, 2004) It is not advised to dilute Valium with any other solution or medication due to precipitation risks, although dilutions at ratios between 1:10 and 1:20 can prevent this. The impact of dilution on drug efficacy and safety remains unclear. To minimize injection site discomfort and thrombophlebitis risk, the following practices are recommended: (Tibbetts, 2004)

✓ Prefer large veins for injection

✓ Perform aspiration prior to injection to confirm venous access and dilute the drug

✓ Insert the needle carefully and adjust patient positioning to prevent venous intimal irritation

The sedative effect of diazepam is less reliable in adolescents and more pronounced in elderly patients. Its use is not recommended during early pregnancy. Diazepam's metabolism is complex, with phase I metabolism taking several hours and phase II up to several days. Less than 20% of the drug is excreted within the first 24 hours, and diazepam can be detected in blood and urine for up to 14 days after IV injection. (Ruggerio, 1975) Clinical recovery begins as metabolism progresses and tissue distribution lowers blood concentration. Due to its viscous nature, needle sizes smaller than 23 gauge are not recommended for diazepam administration. IV injection should be performed after confirming venous access by aspiration. Prior to injection, the patient should be positioned supine in the dental chair and asked to fix

their gaze upward. Normally, the lower edge of the upper eyelid rests just above the iris margin; this should be checked before drug administration. The injection should be given slowly in 2.5 mg (0.5 ml) increments over more than 30 seconds. (Ruggerio, 1975) Doses can be repeated after 30-second intervals. Dilution with aspiration reduces burning sensation and thrombophlebitis risk. (Driscoll et al., 1972)

Initial sedation signs include mild drowsiness, reduced anxiety, and relaxation, at which point the dose may be increased. According to sedation criteria described by Verrill (1972), the effective dose of diazepam is determined by relaxation of the orbicularis oculi muscle; the upper eyelid slowly lowers to cover the iris margin. Drug administration continues until the eyelids cover half the pupil. At this stage, the patient is sedated, and the effective dose has been administered. Eyelid closure typically occurs within 2 - 3 minutes. The patient remains cooperative, can open their eyes upon request, but is usually sedated. Local anesthesia can be administered at this point, with mild reactions possibly observed during the procedure.

Most patients achieve adequate sedation with 10 mg or less of diazepam. Additional dosing may vary individually, but the maximum dose should not exceed 20 mg. Higher doses may cause undesired effects such as euphoria, circulatory, and respiratory depression. Due to slow metabolism, extended sedation through repeated injections may increase the risk of postoperative disorientation, hypotension, and respiratory depression. (Jorgenson & Day, 1973) A dose of 10 mg IV diazepam is typically sufficient to prevent these complications. Most patients requiring periodontal surgery have been successfully sedated with doses of 10 mg or less. (Ruggerio, 1975) If the desired depth of sedation cannot be achieved, dosage can be increased safely with pentobarbital or pentazocine. In these cases, excessive salivation may rarely occur but can be controlled with atropine administration.

b. Midazolam (Dormicum)

Midazolam is another tranquilizer widely used today in general medicine, oral and maxillofacial surgery, and dentistry. This benzodiazepine derivative possesses sedative, hypnotic, and potent amnestic properties, and is distinguished by its short half-life. (Gnanam, David, Srikanth & Siddharth, 2011) Midazolam can be used alone or in combination with other sedative agents.

In a retrospective study involving 372 patients undergoing oral surgery under IV conscious sedation with midazolam, the drug was reported to cause no serious complications; good cooperation with patients was maintained during surgery, and satisfactory treatment outcomes were achieved.

Furthermore, compared to general anesthesia methods, sedation with midazolam was found to be a complementary approach for managing anxious patients and more cost-effective. (Runes & Ström, 1996)

Studies have shown that local anesthesia alone is often insufficient in oral surgery procedures. The combination of ketorolac-articaine containing epinephrine, when administered alongside local anesthesia, was reported to be highly effective. (Juodzbalys et al., 2005) In this study, 90% of patients experienced no pain during the operation, and blood pressure and pulse rate returned to normal values within 5 minutes after midazolam injection. Additionally, anterograde amnesia was observed in 80% of patients, while pathological psycho-emotional conditions were detected in 9% of cases.

c. Propofol

Propofol is a rapidly acting sedative-hypnotic agent with an alkyl structure. It has a short duration of action, a rapid recovery profile, and a low likelihood of excitatory side effects. The most common adverse effects of the drug include injection site pain, hypotension, and transient respiratory depression. (Joseph & Buffalo, 1999) Joseph et al. have reported that propofol is used safely and widely. (Joseph et al., 2006) It has been noted that continuous infusion of propofol reduces opioid requirements and facilitates sedation onset. (Joseph et al., 2005) In patients undergoing controlled sedation, a combination of propofol and low-dose midazolam has been reported not to decrease oxygen saturation or prolong discharge time. (Küçükyavuz & Cambazoğlu, 2004) Ketamine-propofol combination is suggested as a last resort. (Joseph et al., 2012) In a comparison between propofol and diazepam, Ebenezer et al. highlighted propofol's superiority due to its rapid onset of action, deeper amnesia, faster recovery time, earlier discharge capability, and better patient compliance. (Ebenezer, 2013) Additionally, it has been proposed that combining propofol with ketamine or midazolam may provide better sedation and analgesic effects.

In a study comparing midazolam and propofol for conscious sedation during minor oral surgical procedures in terms of analgesia, amnesia, anxiolysis depth, and patient comfort, both drugs exhibited favorable effects on cardiovascular and respiratory parameters; however, propofol caused a greater decrease in heart rate than midazolam. (Gnanam et al., 2011) The same study reported a transient drop in oxygen saturation with propofol and a slight decrease in respiratory rate with midazolam. Propofol's effect had a faster onset compared to midazolam, but its recovery time was found to be longer.

The use of propofol in outpatient settings offers numerous advantages, and this method has been reported to be commonly applied by oral surgeons.

(Alkire, Haier & Barker, 1995) Propofol is metabolized in the liver; over 90% is excreted via urine, and less than 1% is eliminated unchanged in feces. (Casagrande, 2006) Other studies have demonstrated that while midazolam has superior amnestic effects compared to propofol, propofol significantly reduces the incidence of postoperative nausea and vomiting and has a lower incidence of postoperative headache than midazolam. (Coyle et al., 2005) In conclusion, propofol is considered an effective and safe IV conscious sedation agent for minor oral surgical procedures. (Gnanam et al., 2011)

4. Narcotics (Opioids)

The most commonly used narcotic analgesics in conscious sedation are meperidine (Demerol) and morphine. Fentanyl, on the other hand, is classified as a potent analgesic agent primarily used for deep sedation and general anesthesia. (Tibbetts, 2004) Among this group, meperidine is the least potent narcotic analgesic, while morphine is approximately 10 times more potent than meperidine. Fentanyl is about 100 times more potent than morphine. In conscious sedation, rather than the superiority of narcotic drugs, it is crucial to have a thorough understanding of each drug's indications, contraindications, and pharmacological properties. Narcotic analgesics are considered powerful and effective agents for the control of moderate to severe pain. However, their primary side effects are dose-dependent and may result in clinical conditions such as respiratory depression, histamine release, urinary retention, nausea, vomiting, and constipation.

General contraindications for narcotic analgesics include hypersensitivity or intolerance to the drug, acute bronchial asthma, upper airway obstruction, concurrent use of monoamine oxidase (MAO) inhibitors or use within the last 14 days, and increased intracranial pressure or head trauma. Additionally, narcotics should be used cautiously in patients with chronic obstructive pulmonary disease (COPD) or any form of respiratory depression. In elderly, frail patients, and those known to be sensitive to central nervous system depressants, narcotic dosages are generally recommended to be reduced.

Conscious Sedation Techniques

Conscious sedation is a method that can be administered by a physician, dentist, or nurse either in a hospital setting or outpatient clinic. Sedative drugs can be delivered via intravenous (IV) or intramuscular (IM) routes. The effect of the medication typically lasts between 30 to 60 minutes. During the drug's effect, respiratory rate may slow down, and a mild decrease in blood pressure can be observed. Throughout the procedure, the healthcare professional

administering the sedation closely monitors the patient every 3 to 5 minutes and remains present by the patient's side during the entire process.

During sedation, respiratory support is generally not required; however, if necessary, intravenous fluids may be administered via a venous catheter, or oxygen support can be provided using a mask. (Sherwood, Williams, & Prough, 2012) In conscious sedation, the patient may experience mild drowsiness or may not remember the procedure, but it is known that patients can easily respond to verbal stimuli from people around them. Currently, there are 14 different sedative agents available for conscious sedation. In clinical practice, three main sedation methods are most commonly employed: (Tibbetts, 2004)

1.Intravenous (IV) Sedation

IV sedation is generally administered by oral surgeons and dentists with specialized training and certification as a form of deep conscious sedation. Therefore, it is rarely preferred by general dental practitioners. In this method, sedative drugs are administered directly into the bloodstream. (Ceravolo et al., 1980) One of the most significant advantages of IV sedation is the ability to immediately increase the dose if sedation is inadequate. Drugs administered intravenously exhibit a much faster and more potent effect compared to oral administration, enabling deep amnesia with this technique.

Conscious sedation techniques and agents used in periodontal surgery are largely similar to those employed in oral and maxillofacial surgery. The use of general anesthesia and sedation techniques in periodontal surgery dates back many years. In 1967, Burns and Hanan described the use of intravenous hydroxyzine and meperidine in periodontal surgery. In 1970, Ariaudo discussed the role of general anesthesia in hospital operating rooms and noted its appropriateness for periodontal surgery in patients with psychological, organic, or physical disabilities. Moreover, general anesthesia is accepted as necessary in orofacial and oral reconstructive surgeries requiring large-scale bone grafts. Elective surgeries requiring general anesthesia and the presence of organic diseases necessitate thorough physical examinations.

Cohen (1979) studied periodontal and oral surgical procedures involving the maxilla and mandible in 150 patients under general anesthesia or deep sedation. In this research, multiple procedures such as periodontal surgery, impacted tooth extraction, apical resection, and pulpectomy were performed within the same session. General anesthesia protocols included the use of inhalation anesthetics, IV sedatives and tranquilizers, narcotics, and other agents alone or in combination. Control of bleeding involved small infiltrations of 2% lidocaine, and preoperative and postoperative follow-ups were routine in surgeries performed under general anesthesia. General

anesthesia in periodontal surgery is particularly indicated for patients with mental retardation, severe anxiety, or medical complications.

Although the use of IV conscious sedation in periodontal surgery is not a new concept, its routine application remains rare. (Ebenezer, 2013) While this technique yields satisfactory outcomes for some patients, it may not be suitable for all. However, increasing interest in IV sedation within periodontology has been noted. IV sedation effectively enhances patient comfort. In cases where patients do not find local anesthesia safe or comfortable, supplementation with central nervous system depressants has long been recommended. The safest sedation method in local anesthesia is nitrous oxide/oxygen (N_2O/O_2) conscious sedation. (Jorgenson, 1972) Cohen's 1979 study reported IV sedation using short-acting barbiturates, scopolamine, narcotic analgesics, combined with nitrous oxide and oxygen inhalation. These procedures should be performed by appropriately trained teams with patients monitored in inpatient observation units. No major complications were reported in the study; mild complications included nasal bleeding due to conchal fracture caused by nasal intubation, five - day laryngitis, and phlebitis. The absence of postoperative swelling was attributed to administration of 4 mg IM and 4 mg IV dexamethasone immediately after surgery. Greenfield and Caruso (1976) emphasized the importance of this technique in impacted third molar surgery.

Patients undergoing IV sedation are suitable for outpatient treatment but require regular postoperative follow-up similar to patients who receive general anesthesia. All patients are subjected to the same protocols during preoperative and postoperative periods. Periodontal surgery is performed according to standard procedures during sedation. After the operation, the patient is monitored in a recovery room and discharged only when reflexes have sufficiently recovered, accompanied by a responsible adult. The fundamental goal of conscious sedation, regardless of drug administration method, is to reduce fear and anxiety in patients who have difficulty psychologically accepting treatment and thereby facilitate their cooperation. (Ceravolo, 1980)

Various pharmacological agents may be used alone or in combination for conscious sedation. For example, combinations of diazepam with barbiturates and narcotic analgesics are frequently preferred. Ceravolo et al. (1980) applied IV conscious sedation in 5,200 cases; diazepam, meperidine, and methohexital were used in 3,700 cases, while diazepam and methohexital were used alone in 1,500 cases. Patients were evaluated according to ASA classification (3,178 ASA I, 1,767 ASA II, 255 ASA III), and no major complications were reported. Mild complications such as nausea, vomiting, and transient phlebitis were observed but resolved with conservative treatment. The methohexital dose was titrated until mild sedation signs such as slight drowsiness, stuttering, or nystagmus appeared, which was considered the ideal time for local anesthesia administration. (Ceravolo, 1980)

In periodontal surgery, local anesthesia is administered using classical techniques by dividing the oral cavity into four quadrants. All standard periodontal surgical procedures can be performed under conscious sedation in an outpatient setting. Vital parameters such as pulse and respiration are monitored during surgery, and the patient's level of consciousness, comfort, and cooperation are continuously evaluated. Postoperative vital parameters are always recorded. Upon discharge decision, patients must be accompanied by a responsible adult. After sedation, patients are advised not to stand up abruptly, avoid sudden sitting movements, refrain from operating motor vehicles or dangerous machinery, and abstain from alcohol consumption for 24 hours. Short-term bed rest at home is recommended, and a companion must accompany the patient upon leaving the clinic.

Three key points must be considered in IV sedation:

✓ Patients must not be transitioned to general anesthesia; early cortical signs and symptoms of sedation should be recognized.

✓ Dosages are not standardized and require close monitoring due to the risk of overdose and patient age.

✓ Sedation does not replace or eliminate the need for effective local anesthesia.

The literature reports that combinations of IV diazepam or midazolam with nitrous oxide/oxygen inhalation sedation and oral benzodiazepine sedation techniques have successfully alleviated anxiety in most phobic patients. (Tibbetts, 2004)

Other alternative techniques include:

✓ IV sedation with one or more drugs

✓ IV sedation with propofol

✓ Transmucosal sedation

Patients scheduled for conscious sedation undergo detailed medical history review, physical examination, and vital sign monitoring before treatment. Patients who are physically or emotionally unwell are considered appropriate candidates for sedation. (Ceravolo, 1980) On the day of sedation, a responsible adult must accompany the patient. Sedative agents may be administered via intravenous route starting with a 5% dextrose infusion, allowing for small incremental titrations.

Physical Evaluation of the Patient in Intravenous (IV) Sedation

A thorough physical evaluation of all patients prior to dental treatment is medically mandatory. McCarthy (1972) stated that the purpose of the dentist's physical examination is to determine whether the patient is physically and psychologically capable of tolerating the proposed dental procedure. Accordingly, the general health status of each patient must be comprehensively assessed. However, to enhance the accuracy of the assessment and facilitate patient understanding, it is important to keep the health questionnaire as simple and concise as possible. Therefore, standardized forms including brief health screenings are often used.

In IV sedation applications, minimal laboratory tests such as routine urinalysis, hemoglobin, and hematocrit levels are generally requested from the patient. Additionally, blood pressure, pulse rate, and respiratory rate should be recorded during the initial examination.

Management of the Situation

The patient should be provided with a brief and clear explanation of the planned procedure, emphasizing that the treatment will be conducted painlessly and comfortably when necessary. To reduce preoperative anxiety and improve sleep quality, a prescription of 100 mg sodium pentobarbital may be given approximately 15 - 20 minutes before bedtime. This dosage generally ensures uninterrupted sleep for 6 - 7 hours; in rare cases, the dose may be increased for highly anxious patients.

The patient should be given written instructions outlining the preoperative guidelines, which should be discussed in detail. Key considerations to be observed before IV sedation can be summarized as follows:

✓ **Medical History:** Information should be obtained regarding existing illnesses, drug allergies, current medications - especially sleep aids, tranquilizers, or corticosteroids.

✓ **Preparations:** The patient must abstain from eating or drinking for at least 4 hours prior to the appointment. The previous meal should be light and easily digestible. Tight clothing should be avoided in favor of garments that allow easy movement of the elbows. Additionally, dentures, contact lenses, and glasses should be removed before the procedure.

✓ **Sedation Monitoring:** A responsible adult must accompany the patient during and after the sedation procedure. The patient should avoid driving, engaging in hazardous activities, and alcohol consumption on the day of sedation.

Intravenous (IV) Sedation Technique

The patient should be positioned in a supine position on the dental chair. (Tibbetts, 2004) Initially, blood pressure, pulse, and respiratory rate are recorded. A pulse oximeter is placed on the patient's fingertip to continuously monitor the heart rate throughout the procedure. Oxygen is administered via a nasal cannula at a flow rate of 4 - 6 liters per minute, as the drugs used during sedation may cause respiratory depression.

An appropriate venous access is established, and an infusion setup including physiological saline and drug administration is prepared. After vein cannulation, saline infusion is adjusted to 2 - 3 drops per minute to maintain patency of the needle. Before drug administration, the intravenous line must be confirmed to be properly positioned, with the vein visibly clear and accessible. The saline infusion line is temporarily clamped, and medications are administered through the injection site using a needle. Drugs are slowly injected by gently tapping the infusion system until the desired sedation and relaxation are achieved. Additional doses may be administered via the same venous access if the treatment duration is prolonged or emergency interventions are required. The venous line is secured with an angio-cut, hypoallergenic, and transparent surgical tape.

For blood pressure measurement, the cuff is placed on the patient's arm. The stethoscope should be positioned over the medial aspect of the antecubital fossa where the arterial pulse is palpable to ensure accurate blood pressure readings; incorrect placement will lead to erroneous measurements. The cuff pressure is inflated approximately 10 mmHg above the diastolic pressure. Topical anesthetic may be applied to the venipuncture site before needle insertion. Venous access is confirmed by blood flashback in the needle tubing, after which the tourniquet is released and saline infusion commenced. The blood pressure cuff remains on the patient's arm throughout the treatment, and a final measurement is taken at the end.

Drug Selection and the Jorgensen Technique

For oral surgery procedures lasting two hours or longer or for extensive periodontal surgeries, the Jorgensen technique is preferred for IV sedation. (Jorgensen, 1961) This method is one of the oldest and most widely used sedation techniques. The primary drugs utilized are pentobarbital sodium (Nembutal) and meperidine hydrochloride (Dolantin). Before sedation induction, a test dose of approximately 3 mg Nembutal is injected at the latex injection site to detect any hypersensitivity. (Drummond-Jackson, 1971) Subsequently, the dose is gradually increased by 10 mg every 30 seconds while

maintaining verbal communication with the patient to monitor sedation progression.

Pentobarbital doses are titrated until the first signs of cortical depression appear, which include fatigue, reduced anxiety, mild drowsiness, sleepiness, dizziness, and slight blurred vision. This stage is referred to as the "baseline." The required pentobarbital dose to reach baseline varies individually but generally ranges from 30 mg to 300 mg (Ruggerio, 1975), with most patients achieving baseline sedation at 100 mg or less. If sufficient relaxation for surgery is not attained after the initial dose, an additional dose amounting to 10 - 15% of the total pentobarbital dose is administered. The supplementary dose is adjusted based on the amounts of meperidine and scopolamine given. For example, if 30 mg pentobarbital induced baseline sedation, the additional dose should not exceed 5 mg; if 200 mg was required, the booster dose may be up to 30 mg. (Jorgensen, 1972)

Following pentobarbital administration, a combination of meperidine and scopolamine is prepared. This mixture is made in a 5 ml syringe containing 25 mg meperidine, 0.32 mg scopolamine, and sufficient physiological saline. Injection is slowly administered every 30 seconds at a rate of 1 ml via the latex injection site. The meperidine dose is adjusted proportionally not to exceed 25 mg. For example, if less than 100 mg pentobarbital was used, the meperidine dose is halved (approximately 12.5 mg). For 200 mg pentobarbital, the maximum meperidine dose is 25 mg. Meperidine, a narcotic analgesic, increases pain threshold and induces mild euphoria but should not exceed 25 mg due to the risk of respiratory depression. It also must be used cautiously as it can cause nausea and vomiting.

The third drug in the Jorgensen technique, scopolamine, is preferred to reduce salivary secretion and suppress vagal stimulation. Atropine is commonly used today for the same purpose. Scopolamine has been reported to have respiratory stimulant effects in healthy individuals; however, its ability to counteract the respiratory depression caused by narcotics such as morphine is debated. (Ruggerio, 1975) Additionally, scopolamine has amnesic effects but may cause idiosyncratic reactions such as delirium and agitation in some cases. Therefore, atropine is preferred, especially in very elderly or very young patients. (Ruggerio, 1975) Both drugs are generally considered safe, but therapeutic doses may rarely trigger alarm reactions.

Everett and Allen (1971) examined the cardiopulmonary effects of the Jorgensen technique and reported that it effectively eliminated anxiety and tension while causing minimal physiological disturbances. This indicates that sedation techniques not only improve patient and clinician comfort but also enhance patient safety. In patients at risk due to cardiovascular diseases or hypertension, appropriate sedation and local anesthesia use provide a

safer environment than local anesthesia alone. (Ruggerio, 1975) Diazepam, another sedative agent once commonly used for IV sedation, was described in detail previously. Patients must be fully monitored during sedation, and the advantages as well as disadvantages of intravenous sedation should always be considered. (Cohen et al., 1979)

Intravenous (IV) Sedation:

Advantages:

✓ **Depth of Anesthesia:** The anesthesia depth is moderate and minor postoperative discomfort resolves quickly.

✓ **Comfort:** Since no tubes or tampons are applied to the mouth or throat, postoperative complaints such as sore throat are avoided.

✓ **Patient Management:** Management of outpatient treatments is more flexible and easier.

Disadvantages:

✓ **Sedation Control:** In some patients, controlling the anesthesia level and anxiety may be difficult; full relaxation may not be achieved.

✓ **Airway Management:** As with all anesthetic procedures, ensuring proper airway management is essential.

Complications Associated with Venous Access

The most common complication during venous access is hematoma formation. (Howard, Bustillo, & Norton, 1973) Blood leaks into the interstitial space due to puncture of the venous wall, causing swelling and discoloration. This problem can be prevented by inserting the needle into the vein at an appropriate angle. After needle withdrawal, immediate pressure must be applied to the injection site to prevent blood extravasation. Localized hematomas are treated with direct pressure followed by warm compresses. (Ruggerio, 1975)

If the injection technique is incorrect or the needle dislodges, infiltration, i.e., leakage of blood outside the vein, may occur. Short needle and small vein infusion sets offer advantages in preventing needle displacement. The clinician should never administer drugs unless sure the needle is inside the vein. Occasionally, patients may experience a burning sensation during venous entry before drug injection, caused by venous spasm due to trauma from needle insertion.

Meperidine may rarely trigger histamine release, resulting in superficial vessel redness on the forearm or upper arm. This reaction generally resolves spontaneously within minutes. (Ruggerio, 1975) Use of large-bore needles in inappropriate positions, rapid drug injection, or irritant solutions may cause irritation or bacterial contamination of the venous intima, leading to thrombosis and thrombophlebitis. Warm, moist compresses help reduce inflammation, which typically presents as localized swelling, firmness, and tenderness without other inflammatory signs.

Intra-arterial injections are extremely hazardous, potentially causing both drug toxicity and intense, burning pain at the injection site. To avoid arterial injection, arterial pulsations should be carefully palpated before tourniquet placement, especially on the medial side of the antecubital fossa. If the needle inadvertently enters an artery, the patient will feel discomfort, and blood will pulsate rapidly and forcefully into the infusion set due to arterial pulsations.

Precautions Before Intravenous (IV) Sedation

Certain conditions must be met prior to the administration of IV sedation. The procedure should be performed exclusively by a properly trained and experienced team under adequate supervision. Vital signs such as pulse, blood pressure, and respiration must be continuously monitored and recorded throughout sedation. Additionally, the patient should be closely observed to maintain airway patency and respiratory function, with continuous communication maintained - typically by talking to the patient. Comprehensive documentation related to the treatment and post-procedure monitoring is essential. These records should include premedication details, blood pressure, pulse, respiratory rate, administered drugs and dosages, injection site, method of administration, operation duration, and the presence of an accompanying person.

During IV drug administration, an experienced and skilled team must be present to promptly manage minor or major respiratory and cardiovascular complications that may arise. Furthermore, injectable local anesthetics and emergency medications (e.g., vasopressors, antihistamines, corticosteroids, atropine) as well as full resuscitation equipment should be readily available. (O'Day & Driggs, 1973) Oxygen delivery must be accessible in every dental setting.

In summary, safe sedation during oral and periodontal surgical procedures requires thorough understanding and accurate titration of the medications and doses tailored to the patient's needs. While diazepam is preferred for short-duration operations, midazolam is currently widely used as an effective sedative agent for this purpose.

2.Enteral (Oral) Conscious Sedation

The simplest and most common sedation method in dental practice is enteral sedation, achieved by oral administration of sedative drugs. However, due to variability in gastrointestinal absorption both between individuals and within the same individual at different times, the onset and intensity of drug effects cannot be precisely predicted in advance. (Ruggerio, 1975)

Intramuscular (IM) administration is considered safer than oral administration. The most reliable sedation effect is obtained by administering the drug directly and slowly into the bloodstream with dose adjustment accordingly. This method allows both objective and subjective evaluation of the patient's response to the medication. (Trieger, 1973) Consequently, IV sedation has emerged in the literature as a safe and effective sedation technique. (Ruggerio, 1975) However, IV sedation must only be performed by trained practitioners with full knowledge and experience in application and patient monitoring. Continuous monitoring of vital signs and awareness of safety limits are mandatory during sedation.

It is critical that conscious sedation is not deep, as deep sedation can impair airway control by the patient. Deep sedation carries risks if administered by individuals without general anesthesia training. At every stage, the patient should respond to verbal commands and physical stimuli. Moreover, the three fundamental requirements for IV sedation - patient monitoring, appropriate equipment, and emergency preparedness - must always be maintained.

When conscious oral sedation is applied, medications for premedication are selected according to the patient's general health, age, and the nature of the planned procedure. In enteral sedation, the patient takes drugs orally, body functions continue normally, and spontaneous breathing is maintained. This sedation type generally produces drowsiness and some degree of amnesia. The main disadvantage is the unpredictable sedation level due to individual variability. (Tibbetts, 2004) The most commonly used drugs are benzodiazepines administered orally. (Ceravolo et al., 1980) These drugs have sedative properties and also cause mild to significant amnesia in many patients, so the procedures are either minimally remembered or completely forgotten.

The primary advantages of oral sedation are ease of administration and low cost. However, drawbacks include difficulty in adjusting sedation levels, the need for the patient to take the medication prior to treatment, which often prohibits driving or necessitates accompaniment during the visit. Additionally, oral sedation lacks analgesic effects. (Rodgers, 2005) One of the most commonly used enteral drugs is Halcion tablets containing triazolam, a triazolobenzodiazepine with hypnotic effects that induce deep relaxation and

amnesia. (Rodgers, 2005) In children, the most preferred oral sedative agent is liquid Versed (midazolam).

3.Inhalation Conscious Sedation

Inhalation sedation is one of the most commonly used sedation techniques in dentistry, involving the administration of a nitrous oxide/oxygen (N_2O/O_2) mixture, also known as "laughing gas," which has sedative and anxiolytic effects. According to Jastaki's report, approximately 50% of dentists in the United States use N_2O/O_2 alongside local anesthesia to achieve mild conscious sedation. (Jastaki, 1989) In this method, the patient's vital functions remain normal and spontaneous respiration is maintained.

The onset of N_2O/O_2 sedation is rapid, typically within about 20 seconds, and its effects dissipate completely within 3 to 5 minutes after cessation of the gas. Along with oral conscious sedation, inhalation sedation is among the most preferred sedation methods in general and restorative dentistry. (Ceravolo, 1980) Nitrous oxide is characterized by rapid onset, termination, and clearance, which allows precise titration of the dose and quick termination of sedation. (Berman & Graber, 1992)

The protocol for inhalation sedation begins with a 20% N_2O and 80% O_2 mixture, with the N_2O concentration gradually increased by 10% every minute to reach the appropriate sedation level for the patient. At the end of the procedure, 100% oxygen is administered for at least 5 minutes. According to Malamed, a 40% concentration of N_2O is sufficient for sedation in most patients (Malamed, 2003), although some patients may find this dose unpleasant, and approximately 15% may not respond adequately to N_2O. Successful inhalation sedation requires proper psychological preparation of the patient by the dentist. While sedated patients remain aware of their surroundings, conscious sedation effectively reduces anxiety in most mildly anxious patients. However, nitrous oxide is not a sufficiently potent agent for patients with moderate to severe anxiety. At higher concentrations, it may induce deep sedation or general anesthesia, which poses significant risks if administered by untrained practitioners.

Advantages of inhalation sedation include: (Rodgers, 2005)

- ✓ Effectiveness for mild to moderate anxiety
- ✓ Rapid onset and flexible duration of sedation
- ✓ No prolongation of appointment time
- ✓ Precise and easy control of sedation depth
- ✓ Rapid patient recovery with minimal side effects

✓ Analgesic properties

✓ Ability of patients to resume normal activities, including driving, after sedation

Disadvantages:

✓ Insufficient for patients with severe anxiety

✓ Unsuitable for patients with respiratory conditions such as asthma or emphysema

✓ Claustrophobic patients may refuse to tolerate the nasal mask

Devices used in dental inhalation sedation guarantee administration of at least 30% N_2O and generally deliver oxygen concentrations between 50% and 70%. (Rodgers, 2005) However, if the oxygen supply is depleted and the device does not automatically shut off, this can lead to fatal complications if unnoticed by the practitioner. Both oral and inhalation conscious sedation place the patient in a state of mild relaxation, allowing continuous communication and responsiveness from the patient. (Rodgers, 2005)

Risk Assessment

Although conscious sedation is generally considered safe, respiratory complications may occur, especially when multiple drugs are used concurrently. Therefore, during sedation, patients must be continuously monitored by trained healthcare personnel such as physicians or nurses who are capable of supporting respiratory functions if necessary. Consequently, conscious sedation should only be performed by experienced professionals trained specifically in this area. Special caution is warranted when applying IV sedation to elderly patients. Although age itself is not an absolute contraindication, the patient's overall physical status and comorbidities must be carefully considered in treatment planning. In children and adolescents, the effects of IV conscious sedation with benzodiazepines are less predictable; thus, inhalation sedation remains a safer and preferred option in pediatric patients.

Conclusion

While the control of pain through local or general anesthesia provides a suitable environment for surgical interventions, anesthesia alone is often insufficient to address the full spectrum of medical issues encountered. In other words, both conservative treatments and surgical procedures can induce

significant physical and psychological stress in patients, potentially leading to life-threatening emergencies - particularly among emotionally sensitive adults, children, and individuals with systemic diseases. Such stress is also frequently observed in patients with prior painful surgical experiences.

The most effective method to reduce anxiety and excitement-induced stress, prevent systemic emergencies, and create an optimal environment for surgery is preoperative medication, namely conscious sedation. In dental practice, most treatments can be successfully performed using conscious sedation techniques without the need for general anesthesia, except in a limited number of cases where general anesthesia is unavoidable. Given the potential complications associated with pharmacological agents used in conscious sedation, it is imperative that sedation procedures be carried out in well-equipped settings, by experienced teams, and with all necessary emergency intervention equipment readily available.

When enteral (oral), inhalation, combined enteral - inhalation, intramuscular (IM), and intravenous (IV) conscious sedation techniques are effectively utilized, a less stressful, more comfortable, and efficient working environment is achieved for the dentist, patient, and clinical team. Enteral and/or inhalation sedation is particularly preferred to reduce anxiety and fear in oral and periodontal surgery patients. IV conscious sedation is considered the most reliable method for managing patients with mild to moderate anxiety, as well as those with mental health issues or severe anxiety. The pharmacological agents used in conscious sedation, their combinations, and dose adjustments must be administered with great caution, as sedatives, hypnotics, and narcotic analgesics have central nervous system and respiratory depressant effects. The combined use of multiple drugs may potentiate these effects, leading to serious complications. However, when drugs are carefully titrated and dosed during IV conscious sedation, vascular and systemic complications can be effectively prevented.

Considering the fundamental principles of conscious sedation, based on oral surgery practices, the outcomes and recommendations for healthy adult patients can be summarized as follows: rather than combining numerous sedatives, hypnotics, and narcotics, IV conscious sedation performed with careful titration and dosing of a benzodiazepine, alongside intravenous fluid infusion in a well-equipped physical environment by an experienced specialist team, with continuous monitoring of the patient's vital signs, provides the desired duration and depth of sedation while minimizing possible complications when combined with local anesthesia.

REFERENCES

Album, M.M.: General anaesthesia and premedication in dentistry for children. J. Dent. Child. 24:4:215-223, 1957.

Amar, S., & Chung, K. M. (1994). Influence of hormonal variation on the periodontium in women. Periodontology 2000, 6, 79–87.

Amir, J., Harel, L., Smetana, Z., & Varsano, I. (1997). Treatment of herpes simplex gingivostomatitis *with aciclovir in children: a randomised double blind placebo controlled study. BMJ (Clinical research ed.), 314(7097), 1*800–1803.

Armitage G. C. (2013). Bi-directional relationship between pregnancy and periodontal disease. Periodontology 2000, 61(1), 160–176.

Avila, G., Galindo-Moreno, P., Soehren, S., Misch, C. E., Morelli, T., & Wang, H. L. (2009). A novel decision-making process for tooth retention or extraction. Journal of periodontology, 80(3*), 476–491.*

Azouni, K. G., & Tarakji, B. (2014). The trimeric model: a new model of periodontal treatment planning. Journal of clinical and diagnostic research : JCDR, 8(7), ZE17–ZE20.

Bates, G. W., & Bowling, M. (2013). Physiology of the female reproductive axis. Per*iodontology 2000, 61(1), 89–102.*

*Bichara, J., Greenwell, H., Drisko, C., Wittwer, J. W., Vest, T. M., Yancey, J., Goldsmit*h, *J*., & Rebitski, G. (1999). The effect of postsurgical naproxen and a bioabsorbable membrane on osseous healing in intrabony defec*ts. Journal of periodontology, 70(8), 869–877.*

Blackwood,K.,S.,R.: Sedation for conservative dentistry. British Dental Journalof clinical pract; 23; 365,1969.

Bosshardt, D. D., & Sculean, A. (2009). Does periodontal tissue regeneration really work?. Periodontology 2000, 51, 208–219.

Boyapati, L., & Wang, H. L. (2007). The role of stress in periodontal disease *and wound healing.* P*e*riodontology 2000, 44, 195–210.

Brägger, U., Mühle, T., Fourmousis, I., Lang, N. P., & Mombelli, A. (1997). Effect of the NSAID flurbiprofen on remodelling after periodontal surgery. Journal of periodontal research, 32(7), 575–582.

Casagrande A. M. (2006). Propofol for office oral and maxillofacial anesthesia: the case against low-dose ketamine. Journal of oral and maxillofacial surgery : official journal of the American Association of Ora*l and Maxi*ll*ofa*cial Surgeons, 64(4), 693–695.

Ceravolo,F.J., Meyers,H., Baraff,L.S. and Bennett,C.R.: Full Dentition Periodontal Surgery Ut*ilizing Intravenous Conscious-*Sed*at*ion: A report of 5200 Cases J.Periodontol. 51(8):462-464, 1980.

Chakraborty, S., Tewari, S., Sharma, R. K., Narula, S. C., Ghalaut, P. S., & Ghalaut,

V. (2014). Impact of iron deficiency anemia on chronic periodontitis and superoxide dismutase activity: a cross-sectional study. Journal of periodontal & implant science, 44(2), 57–64.

Chen, F. M., & Jin, Y. (2010). Periodontal tissue engineering and regeneration: current approaches and expanding opportunities. Tissue engineering. Part B, Reviews, 16(2), 219–255.

Cohen C. I. (1979). Periodontal *surgery for the apprehensive patient* with anesthetic management. A review of 150 patients. Journal of periodontology, 50(1), 28–30.

Coyle, T. T., Helfrick, J. F., Gonzalez, M. L., Andres*en, R. V., & Perrott, D. H. (2005). Office-based am*bula*t*ory anesthesia: Factors that influence patient satisfaction or dissatisfaction with deep seda*tion/general anesthesia*. Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofac*ial Surgeons, 63(2), 163*–172.

Çağlayan, G. P*eriodontoloji, İstanbul, Hacettepe Üniversitesi Yayınla*rı, 2010.

Çağlayan G. Gingivektomi. Periodontoloji. Hacettepe Üniversitesi Yayınları, 2010.

Çağlayan G. Hasta Muayenesi ve Muayene Metodları. Periodontoloji. Hacettepe Üniversitesi Yayınları, 2010.

Driscoll, E. J., Smilack, Z. H., Lightbody, P. M., & Fiorucci, R. D. (1972). Sedation with intravenous diazepam. Journal of oral surgery (American Dental *Association : 1965), 30(5), 332–343*.

Ebenezer, V. et al. Conscious sedation after administration of drugs in dentistry. Int J Pharm Bio Sci. 4(2):168-172, 2013.

Edwards, B. J., & Li, J. (2013). Endocrinology of menopause. Periodontology 2000, 61(1), 177–194.

El-Shinnawi, U. M., & El-Tantawy, S. I. (2003). The effect of alendronate sodium on alveolar bone loss in periodontitis (clinical trial). Journal of the International Academy of Periodontology, 5(1), 5–10.

Feres, M., Figueiredo, L. C., Soares, G. M., & Faveri, M. (2015). Systemic antibiotics in the treatment of periodontitis. Periodontology 2000, 67(1), 131–186.

Flores-de-Jacoby L, Mengel R. Conventional surgical *procedures. Periodontol 2000 1995;9:38-54*.

Foreman, P. A., Neels, R., & Willetts, P. W. (1968). Diazepam in dentistry. Clinical observations based on treatment of 167 patients in general d*ental practice. Anesthesia progress, 15(9), 253–259.*

Gaggl, A. J., Rainer, H., Grund, E., & Chiari, F. M. (2006). Local oxygen therapy for treating acute necrotizing periodontal disease in smokers. Journal of periodontology, *77(1), 31–38.*

Genco, R. J., *&* Borgnakke, W. S. (2013). Risk factors for periodontal disease. Periodontology 2000, 62(1), 59–94.

Geurs N. C. (2007). Osteoporosis and periodontal disease. *Periodontology 2000, 44, 29–43.*

Gjermo P. Clorhexidine in dental practice. J Clin Periodontol 1974;1:143-152

*Gnanam,A, Dav*id,J.J, Srikanth,B., Siddharth,D.: Efficacy of Propofol and Midazolam in conscious sedation in mimor oral surgery – A comparative study. SRM University Journal of Dental Sciences, Aprile-June, 2(2):96-99, 2011.

Goodman, A. L., & Hodgen, G. D. (1983). The ovarian triad of the primate menstrual cycle. Recent progress in hormone research, 39, 1–73.

Gougeon A. (1986). Dynamics of follicular growth in the human: a model from preliminary results. Human reproduction (Oxford, England), 1(2), 81–87.

Gusberti, F. A., Mombelli, A., Lang, N. P., & Minder, C. E. (1990). Changes in subgingival microbiota during puberty. A 4-year longitudinal study. Journal of clinic*al periodontology, 17(*10*),* 685–692.

Güncü, G. N., Tözüm, T. F., & Cağlayan, F. (2005). Effects of endogenous sex hormones on the perio*dontium--review of* literature. Australian dental journal, 50(3), 138–145.

Güncü GN, Çağlayan F. Flep Operasyonu. Periodontolo*ji. Hacettepe Üniversit*esi Yayınları, 2010.

Haffajee, A. D., Dibart, S., Kent, R. L., Jr, & Socransky, S. S. (1995). C*linical and microbiolog*ical changes associated with the use of 4 adjunctive systemically administe*red agents in the t*reatment of periodontal infections. Journal of clinical periodontology, 22(8), 618–627.

Hakkı SS. *Periodontal Hastalıklar* ve Beslenme. Periodontoloji. Hacettepe Üniversitesi Yayınları, 2010.

Haytac MC, Ozcelik O. Sistemik Hastalıklar ve Durumların Periodontal Dokulara Etkileri. Periodontoloji. Hacettepe Üniversit*esi Yayınları, 2010.*

*Hertzog, J. H., Ca*mpbell, J. K., Dalton, H. J., & Hauser, G. J. (1999). Propofol anesthesia for invasive procedures in ambul*atory and hospitalized children: exp*erience in the pediatric intensive care unit. Pediatrics, 103(3), E30.

Hugoson A. (1971). Gingivitis in pregnant women. A longitudinal clinical study. Odontologis*k revy, 22(1), 65–84.*

Iacopino A. M. *(*2001). Periodontitis and diabetes interrelationships: role of inflammation. Annals of periodontology, 6(1), 125–137.

Ivanovski S. (2009). Period*ontal regeneration. Aust*ral*ia*n dental journal, 54 Suppl 1, S118–S128.

Jackson, D. L., & Johnson, B. S. (2002). Conscious sed*ation for dentist*ry*:* risk management and patient selection. Dental clinics of North America, 46(4), 767–780.

Jensen, J., Liljemark, W., & Blo*omquist, C. (1981). The effec*t of female sex hormones on subgingival plaque. Journal of periodontology, 52(10), 599–602.

Joseph, E. … et al.: Modern intravenous sedation for Office based full face Laser resurfacing using a continuous infusion propofol pump. J Oral maxillofacial Surg; 63; 903-907,2005.

Joseph. E. et al.: Analysis of propofol and low dose ketamine admixture for adult outpatient dentoalveolar surgery. Aprospective, Randomised. Positive controlled clinical trial. J Oral Maxillofacial Surg; 2012: 70; 537-546.

Juodzbalys, G., Giedraitis, R., Machiulskiene, V., Huys, L. W., & Kubilius, R. (2005). New method of sedation in oral surgery. The Journal of oral implantology, 31(6), 304–308.

Kaldahl, W. B., Kalkwarf, K. L., Patil, K. D., Molvar, M. P., & Dyer, J. K. (1996). Long-term evaluation of periodontal therapy: I. Response to 4 therapeutic modalities. Journal of periodontology, 67(2), 93–102.

Kanasi, E., Ayilavarapu, S., & Jones, J. (2016). The aging population: demographics and the biology of aging. Periodontology 2000, 72(1), 13–18.

Klokkevold PR, Carranza FA. Acute gingivak infections. In: Carranza's Clinical Periodontology. 11th edition. Saunders, St. Louis, 2012:97-103.

Knight, E. T., Liu, J., Seymour, G. J., Faggion, C. M., Jr, & Cullinan, M. P. (2016). Risk factors that may modify the innate and adaptive immune responses in periodontal diseases. Periodontology 2000, 71(1), 22–51.

Kornman, K. S., & Loesche, W. J. (1980). The subgingival microbial flora during pregnancy. Journal of periodontal research, 15(2), 111–122.

Kornman, K. S., & Loesche, W. J. (1982). Effects of estradiol and progesterone on Bacteroides melaninogenicus and Bacteroides gingivalis. Infection and immunity, 35(1), 256–263.

Kumar P. S. (2013). Sex and the subgingival microbiome: do female sex steroids affect periodontal bacteria?. Periodontology 2000, 61(1), 103–124.

Küçükyavuz, Z., & Cambazoğlu, M. (2004). Effects of low-dose midazolam with propofol in patient-controlled sedation (PCS) for apicectomy. The British journal of oral & maxillofacial surgery, 42(3), 215–220.

Lang, N.P., ve Lindhe, J. Clinical Periodontology and İmplant Dentistry, John Wiley & Sons, 2015.

Leblebicioglu, B., Connors, J., & Mariotti, A. (2013). Principles of endocrinology. Periodontology 2000, 61(1), 54–68.

Lindhe, J., & Björn, A. L. (1967). Influence of hormonal contraceptives on the gingiva of women. Journal of periodontal research, 2(1), 1–6.

Lindhe, J., Attström, R., & Björn, A. L. (1969). The influence of progestogen on gingival exudation during menstrual cycles. A longitudinal study. Journal of periodontal research, 4(2), 97–102.

Loesche, W. J., Syed, S. A., Laughon, B. E., & Stoll, J. (1982). The bacteriology of acute necrotizing ulcerative gingivitis. Journal of periodontology, 53(4), 223–230.

Lowell R. *J. (1967). Premedication*, *Lo*cal and General Anesthesia in Dentistry. Anesthesia Progress, 14(4), 92.

Lysell, L., & Rohlin, M. (1988). A study of indications us*ed for removal of the mand*ib*ul*ar third molar. International journal of oral and maxillofacial surgery, 17(3), 161–164.

MacPhee T & Cowley G. Essentials of Periodontology. *3rd edition. Oxford: Ba*ck*we*ll Science, London, 1981:157 – 177.

Malamed,S,F.: Sedation: a guide to patient manageme*nt, ed 4. St. Lo*uis, Mosby, 2003.

Malamed S. F. (1986). Conscious sedation and general anesthesia techniques and drugs used in dentistry. Anesthesia progress, 33(4), 176–178.

Mariotti, A., & Mawhinney, M. (2013). Endocrinology of sex steroid hormon*es and cell dynamics in the* per*i*odontium. Periodontology 2000, 61(1), 69–88.

Mariotti A. (1994). Sex steroid hormones and cell dynamics in the periodontium. Critical reviews in oral biology and medicine : an official publication of the American A*ssociation of Oral Biologists, 5(1)*, *27*–53.

Mombelli, A., Rutar, A., & Lang, N. P. (1995). Correlation of the periodontal status 6 years after puberty with clinical and microbiological conditions during puberty. Jo*urnal of clinical periodo*nto*l*ogy, 22(4), 300–305.

Mongini, F., Bona, G., Garnero, M., & Gioria, A. (1993). Efficacy of meclofenamate sodium versus *placebo in headache and craniofacial pain. Headach*e, 33(1), 22–28.

Monheim L. M. (1970). General anesthesia in dental practice. Dental clinics of North America, 14(4), 805–820.

Motta, P. M., Makabe, S., & Nottola, S. A. (1997). The ultrastructure of human reproduction. I. The natural history o*f the female germ cell: origi*n, migration and differentiation inside the developing ovary. Human reproduction update, 3(3), 281–295.

N*abers, C.L., ve Sta*lk*er*, W.H. Periodontal therapy. Toronto: BC Decker. Inc.-1990. -194, 1990.

Najeeb, S., Zafar, M. S., Khurshid, Z.*, Zohaib, S., & Alm*as, K. (2016). The Role of Nutrition in Periodontal Health: An Update. Nutrients, 8(9), 530.

Nakagawa, S., Fujii, H., Machida, Y., & Okuda, K. (1994). A longitudinal *study from prepuberty to puberty of* gingivitis. Correlation between the occurrence of Prevotella intermedia and sex hormones. Journal of clinical periodontology, 21(10), 658–665.

Newman, M.G., Takei, H., Klokkevold, P.R., ve Carranza, F.A. Carranza's clinical peri*odontology, 12. Baskı, Elseiver health* scien*c*es. 2015.

Newm*an GN, Takei HH, Klokkevold PR, Car*ran*z*a FA. Surgical Therapy In: Carranza's Clinical Periodontology. 11 th edition. Saunders, St.Louis, 2012.

Nippoldt, T. B., Reame, N. E., Kelch, R. P., & Marshall, J. C. (1989). The roles of estradiol and progesterone in decreasing lut*einizing hormone pulse frequency in the luteal phase o*f *t*he menstrual cycle. The Journal of clinical endocrinology and metabolism, 69(1), 67–76.

Nyman, S., Lindhe, J., Karring, T., & Rylande*r, H. (1982). New* at*ta*chment following surgical treatment of human periodontal disease. Journal of clinical periodontology, 9(4), 290–296.

Nyman, S., Schroeder, H. E., & Lindhe, J. (1979). Suppression of inflammation and bone resorption by indomethacin during experimental periodontitis in dogs. Journal of periodontology, 50(9), 450–461.

Otomo-Corgel J. (*2013). Dental management of the fem*ale patient. Periodontology 2000, 61(1), 219–231.

Özer, N., Erol, B.: Oral Cerrahide İntravenöz Diazepam Ve Midazolamın Amnezik Etkilerinin Araştırılması. D.Ü. DişHek. Fak. Derg., 3(1-2): 45-50, 1992.

Özçaka, Ö., Ceyhan, B. Ö., Akcali, A., Biçakci, N., Lappin, D. F., & Buduneli, N. (2012). Is there an interaction between polycystic ovary syndrome and gingival inflammation?. Journal of periodontology, 83(12), 1529–1537.

Özçelik O, Haytac MC. Kadınlarda Rast*lanan Hormonal Değişikliklere Bağlı Periodontal Durumla*r. *P*eriodontolojii Hacettepe Üniversitesi Yayınları, 2010.

Pankhurst, C. L., Waite, I. M., Hicks, K. A., Allen, Y., & H*arkness, R. D. (1981). T*he influence of oral contraceptive therapy on the periodontium--d*uration of drug therapy.* Jo*urnal of p*eriodontology, 52(10), 617–620.

Polimeni, G., Xiropaidis, A. V., & Wikesjö, U. M. (2006). Biology and principles of periodontal wound healing/regeneration. Periodontology 2000, 41, 3*0–47.*

*Preshaw, P. M., Kn*utse*n*, M. A., & Mariotti, A. (2001). Experimental gingivitis in women using oral contraceptives. Journal of dental research, 80(*11), 2011–2015.*

*Prichar*d,J.F.: Advanced Periodontal Disease. Ed.2, W.B.Saunders, Philadelphia, 1972.

Reves JG, Glass PSA, Lubarsky DA, et al. Intravenous anesthetics. In: Miller RD, Eriksson LI, Fleisher LA, et al., *eds. Miller's Anesth*esi*a*. Ed.7. Philadelphia, PA: Elsevier Churchill-Livingstone; 2009.

Reynolds M. A. (2014). Modifiable risk factors in periodontitis: at the intersection of aging and disease. Periodontology 2000, 64(1), 7–19.

Robb, N. D., & Hargrave, S. A. (1993). Toler*ance to* in*tr*avenous midazolam as a result of oral benzodiazepine therapy: a potential problem for the provision of conscious sedation in dentistry. Anesthesia & pain control in dentistry, 2(2), 94–97.

Rocha, M. L., Malacara, J. M., Sánchez-Marin, F. *J., Vaz*que*z* de la Torre, C. J., & Fajardo, M. E. (2004). Effect of alendronate on periodontal disease in postmenopausal women: a randomized placebo-controlled trial. Journal of periodontology, 75(12), 1579–1585.

Rodgers S. F. (2005). Safety of intravenous sedation administered by the operatin*g oral surgeon: the first 7 years* of office practice. Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons, 63(10), 1478–1483.

Rogers, M. *J., Gordon, S., Benford,* H. L., Coxon, F. P., Luckman, S. P., Monkkonen, J., & Frith, J. C. (2000). Cellular and molecular mechanisms of action of bisphosphonates. Can*cer, 88(12 Suppl),* 2961–2978.

Ruggerio A. C. (1975). Intravenous sedation of the periodontal surgical patient. Journal of periodontology, 4*6(6), 319–327.*

*Rya*n, *M*. E., Carnu, O., & Kamer, A. (2003). The influence of diabetes on the periodontal tissues. Journal of the American Dental Association (1939), 134 Spec No, 34S–40S.

Sarasin, D. S., Ghoneim, M. M., & Block, R. I. (1996). Effects *of sedation with midazol*am *o*r propofol on cognition and psychomotor functions. Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons, 54(10), 1187–1193.

*Sha*w, *I*, Kumar, C, Dodds, C. (Edit.): Oxford Textbook of Anaesthesia for Oral and Maxillofacial Surgery, Chapter: Conscious Sedat*ion. Pxford University Press, July 2011.*

Sherwood E*R, Williams* CG, Prough DS. Anesthesiology principles, pain management, and conscious sedation. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL, eds. Sabiston Textbook of Surgery. *Ed. 19, Philadelphia PA: Elsevier Saunders, 2012.*

*Shiau, H. J., & Rey*nolds, M. A. (2010). Sex differences in destructive periodontal disease: exploring the biologic basis. Journal of periodontology, 81(11), 1505–1517.

Shinwari, M. S., Tanwir, F., Hyder, P. R., & Bin Saeed, M. H. (2014). Host modulation therapeutics *in periodontics: role as an adjunctive periodo*ntal therapy. Journal of the College of Physicians and Surgeons--Pakistan : JCPSP, 24(9), 676–684.

Straub R. H. (2007). The complex role of estrogens in inflammation. Endocrine reviews, 28(5), 521–574.

Şüküroğlu E, Çağlayan F. Sistemik antibiyotik kullanımı. Türkiye Kli*nikleri J Periodontol-Special Topic*s 2016:2(3):7-19

Tarkkila, L., Furuholm, J., Tiitinen, A., & Meurman, J. H. (2008). Oral health in perimenopausal and early postmenopausal women f*rom baseline to 2 years of* fo*llo*w-up with reference to hormone replacement therapy. Clinical oral investigations, 12(3), 271–277.

Tibbetts,L,S.: Conscious sedation. In Rose,L,S, Mealey,B,L, Genco,R,J, Cohen,D,W, eds. Periodontics. Chap.19. pp.323-357, Elsevier-Mosby, China, 2004.

Tilakaratne, A., Soory, M., Ranasinghe, A. W., Corea, S. M., Ekanayake, S. L., & de Silva, M. (2000). Effects of hormonal contraceptives on the periodontium, in a population of rural Sri-*Lankan women. Journal of cl*inical periodontology, 27(10), 753–757.

Van der Velden, U., Kuzmanova, D., & Chapple, I. L. (2011). Micronutritional approaches to periodontal therapy. Journal of clinical periodontology, 38 Suppl 11, 142–158.

von Wowern, N., & Nielsen, H. O. (1989). The fate of impacted lower third molars after the age of 20. A four-year clinical follow-up. International journal of oral and maxillofacial surgery, 18(5), 277–280.

Wennström, J., & Lindhe, J. (1979). Effect of hydrogen peroxide on developing plaque and gingivitis in man. Journal of clinical periodontology, 6(2), 115–130.

Wolf, H.F., Rateitschak, E.M., Rateitschak, K.H., ve Hassel, T.M. Color Atlas of Dental Medicine. Periodontology. Thieme. *3. Baskı, 2005.*

Wood, N., & Sheikh, A. (1986). Midazolam and diazepam for minor oral surgery. British dental journal, 160(1), 9–12.