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Periodontal problems in menopausal women

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Abstract

Introduction: Menopause is a critical period marked by hormonal changes that significantly impact oral health. Estrogen deficiency alters the oral microbiome, increases the risk of periodontal diseases, and contributes to xerostomia and Burning Mouth Syndrome (BMS). Additionally, postmenopausal women undergoing bisphosphonate therapy for osteoporosis face a higher risk of osteonecrosis of the jaw (ONJ), particularly after extractions or implant placement. Aim: This study evaluates the impact of menopause on periodontal health, oral microbiome changes, xerostomia, BMS, ONJ, and dental implant success. Materials and Methods : A literature review was conducted on menopause-related periodontal diseases, microbiome alterations, salivary dysfunction, and complications affecting dental treatments using PubMed, Web of Science, and Google Scholar databases. A total of 54 articles were selected for analysis. Results: Menopausal women are more susceptible to periodontal diseases and oral discomfort due to microbiome shifts and reduced immune response. ONJ risk is heightened in bisphosphonate users, while delayed bone remodeling may affect implant success. Conclusions: Menopause-related oral health issues require early diagnosis and tailored treatment strategies. A proactive approach to periodontal care, salivary

dysfunction, and implant planning is essential to maintaining oral health and improving quality of life.

Keywords: periodontal disease, oral health, menopause, oral microbiome, dental implants, osteonecrosis, Burning Mouth Syndrome, xerostomia

Introduction

The menopausal period is characterized by various symptoms affecting the whole body, including oral cavity. However, conditions like dry mouth and burning sensations or periodontal diseases are rarely linked to hormonal changes [1–4]. Scientific evidence on connection between menopausal hormonal fluctuations and oral discomfort remains limited, as most studies focus on pregnancy rather than menopause [5,6]. However, in clinical practice, many patients with periodontal problems are menopausal women, highlighting the need for both gynecologists and dentists to recognize these estrogen deficiency-related issues. While dental care is primarily a dentist's responsibility, physicians should encourage patients to maintain good oral hygiene and attend dental visits, referring them to a periodontist at the first signs of periodontal disease [2,3]. The oral cavity is a complex and sensitive organ, and hormonal changes during menopause can directly impact its health due to the presence of estrogen receptors in the oral mucosa [7,8]. As a result, changes in hormone levels may influence oral well-being, making it essential to explore the effects of menopause on oral health and the potential role of hormone replacement therapy (HRT). Additionally, bisphosphonates, commonly prescribed for osteoporosis that often occurs during menopause, have been controversially linked to osteonecrosis of the jaw, causing problems during dental extractions and implantations among patients [1].

Oral microbiome

Early research of the oral microbiome primarily relied on gene sequencing, focusing exclusively on bacteria. Studies have identified over 700 bacterial species, mainly from a few dozen genera with core bacterial species being largely found among individuals [9]. The most common oral microorganisms include *Streptococcus, Actinomyces, Veillonella, Fusobacterium,*

Porphyromonas, Prevotella, Treponema, Neisseria, Haemophilus, Eubacteria, Lactobacterium, Capnocytophaga, Eikenella, Leptotrichia, Peptostreptococcus, Staphylococcus, and Propionibacterium [7,10]. However, variations in their strain differences, abundance and rare species contribute significantly to individual microbiome diversity. Advances in sequencing technology and bioinformatics have enabled researchers to detect organisms beyond bacteria, including viruses, fungi, and archaea. As their significance becomes clearer, these less-studied microbial groups are now receiving greater research attention [11].

Modern research among microbiomes has changed from focusing on individual pathogens to analyzing polymicrobial interactions, recognizing that networks of microorganisms collectively contribute to oral diseases [12]. The oral microbiome is continuously shaped by external factors, such as diet and hygiene [13–16]. Early colonizers of the oral cavity, including *Streptococcus mitis, Streptococcus sanguinis, Streptococcus gordonii, and Streptococcus salivarius*, set themselves before teeth emerge, forming beginnings of complex microbial communities [17]. Once teeth develop, a protective glycoprotein layer facilitates the formation of dental plaque, which creates microenvironments that favor specific bacterial species. The modern Western diet has led to an increase in acid-producing bacteria and periodontal pathogens, highlighting the significant relationship between nutrition and oral health [13,14].

In patients with periodontal diseases microbial homeostasis is imbalanced and leads to inflammation and eventually gingivitis and periodontitis [18]. Gingivitis is a reversible condition but can progress to periodontitis if left untreated. In contrast, periodontitis is characterized by permanent bone loss and is categorized based on its severity and progression into different stages [11,18]. The most popular species of bacteria associated with periodontal disease include *Porphyromonas*, *Treponema* and *Tannerella* [19].

The oral gingiva is sensitive to progesterone and estrogen, which influence periodontal health in various ways. Estrogen promotes the proliferation of gingival fibroblasts, helps reduce T-cell mediated inflammation, and inhibits the chemotaxis of polymorphonuclear leukocytes (PMNL) [20]. Fluctuations in female sex hormones have been associated with different periodontal changes. During puberty, rising hormone levels are linked to increased gingival inflammation and a higher prevalence of *Prevotella intermedia* [21]. Similarly, during pregnancy, the severity of gingival inflammation correlates with hormone levels, often decreasing after childbirth [20]. Additionally, certain pathological microbiomes in subgingival biofilms, including *Treponema*

denticola and *Prevotella intermedia*, have been shown in vitro to be influenced by female sex hormones [22,23]. Postmenopausal declines in estrogen levels are believed to contribute to periodontal disease by promoting inflammation and increasing alveolar bone resorption [24]. Studies have linked these hormonal changes to increased gingival inflammation and greater clinical attachment loss, particularly during the early stages of menopause [25].

Research conducted by Soliman et al. [24] examined the relationship between menopausal hormone therapy and the composition of the subgingival microbiome in postmenopausal women. The findings revealed that women who had never used HT exhibited significantly higher microbial diversity compared to current HT users. These differences remained consistent even after adjusting for age, BMI, and oral hygiene. The study suggests that HT use may influence the subgingival microbiome, potentially contributing to its previously observed protective effect against periodontal disease in older women. Moreover, a cohort study conducted by Tarkkila et al. [26] examined of 106 women aged 50–58 years found that hormone replacement therapy reduced the presence of periodontal pathogens *Porphyromonas gingivalis, Prevotella intermedia,* and *Treponema forsythia* in subgingival plaque. Furthermore, studies in mice suggest that estrogen influences IL-1 production and contributes to females' resistance to spreading dentoalveolar infections by promoting their localized containment. These findings highlight the potential role of sex hormones in regulating oral mucosal infections. In addition, a study performed by LaMonte et al. [27] examined the link between oral microbiota and blood pressure in postmenopausal women. Analysis of subgingival plaque from 1,215 participants identified 47 bacterial species differing by blood pressure status. Over 10.4 years, 15 species were associated with hypertension risk, suggesting oral bacteria may influence blood pressure regulation.

Periodontal disease

Periodontal disease is ranked 7th in prevalence globally, with 1.1 billion prevalent cases in 2019 [28]. The understanding of periodontal disease etiology has evolved significantly over the past [29]. One of the earliest theories, proposed in the late 19th century, suggested that excessive dental and gingival plaque accumulation was the primary cause of infection. At that time, periodontitis was referred to as pyorrhea alveolaris or Riggs' disease and was observed in both generalized and localized forms. It was soon recognized that plaque removal was the most

effective method for preventing symptoms, marking a key step in understanding the microbial role in periodontal disease development [30].

Periodontitis is a chronic inflammatory disease, with serious health consequences including alveolar bone and tooth loss, and masticatory dysfunction affecting nutrition, function of speech and quality of life [31]. Diagnosing periodontal disease requires a thorough understanding of periodontal anatomy and what defines periodontal health [32]. In a healthy state, gums surrounding the teeth appear stippled and pale or coral pink [33]. The gingiva is firmly attached to the underlying structures, forming a sharp margin at the cemento-enamel junction (CEJ). A healthy gingival crevice measures 1–3 mm in depth and does not bleed upon gentle probing, though it contains a small amount of gingival crevicular fluid that is continuously produced. The fluid helps to regulate the balance between subgingival microbial growth and the body's immune defenses. It plays a key role in recruiting neutrophils and other immune cells to support both innate and adaptive immune responses. Below the free gingival margin lies the attached gingiva, a firm and immobile keratinized tissue, while the alveolar mucosa, which is more mobile and non-keratinized, continues beyond the mucogingival junction. Any deviation from these characteristics may indicate periodontal disease [32,34,35].

A study conducted by Agrawal et al. [36] investigated the periodontal status of premenopausal and postmenopausal women, analyzing 60 female patients aged 40–60 years. The test group included 30 premenopausal women, while the control group consisted of 30 postmenopausal women, both with and without chronic periodontitis. Clinical parameters were assessed, and statistical analysis revealed significantly higher plaque index, gingival index, calculus index, pocket probing depth, and clinical attachment loss in postmenopausal women. The findings suggest that postmenopausal women are more prone to periodontitis, emphasizing the importance of early oral disease management.

However there are numerous studies revealing the positive impact of HRT on the progression of periodontal disease [7,37,38]. A study conducted by Taguchi et al. [37] examined the effects of estrogen use on tooth retention, oral bone height, and oral bone porosity in postmenopausal women. Results showed that estrogen users tended to have more posterior teeth than nonusers. However, analysis indicated that the duration of estrogen use was significantly linked to higher total tooth retention, independent of age and oral bone height. These findings suggest that estrogen may support tooth retention by enhancing periodontal attachment. Furthermore, a

study conducted by Chaves et al. [39] also revealed that periodontal parameters such as bleeding on probing (BOP), indicating gingivitis, reduce because of HRT.

Osteonecrosis and dental implants

Menopause-related osteoporosis is responsible for weakening bones, increasing the risk of fractures, including the jaw. Bisphosphonates, commonly prescribed to prevent bone loss, are effective in strengthening bones but have been linked to bisphosphonate-related osteonecrosis of the jaw (BRONJ), particularly with prolonged use or intravenous administration [1]. Patients on bisphosphonates may experience impaired bone healing, making dental implants and surgical procedures riskier due to reduced osseointegration potential and susceptibility to necrosis [40]. Treatment of BRONJ includes antimicrobial rinses, systemic antibiotics, discontinuation of bisphosphonate therapy, no dental therapy or minimally invasive dental therapy (root canal treatment instead of extraction) [40,41].

Study conducted by Ko et al. [42] examined the impact of menopause on cortical bone thickness at prospective dental implant sites. Researchers compared two groups of women: a younger group (<50 years old) and an older, postmenopausal group (>50 years old), analyzing a total of 340 implant sites using cone beam computed tomography (CBCT). Results showed that cortical bone was thickest in the posterior mandible, followed by the anterior mandible, anterior maxilla, and posterior maxilla in both groups. However, the postmenopausal group had an overall lower mean bone thickness compared to the younger group, with a significant reduction observed specifically in the posterior maxilla. These findings suggest that postmenopausal bone loss may affect implant stability, particularly in the upper jaw, emphasizing the need for careful planning in implant placement for older women.

By contrast, an evaluation study performed by Toy et al. [43] studied the long-term success and marginal bone loss (MBL) of dental implants in postmenopausal women with osteoporosis or osteopenia. The results of the research indicated that postmenopausal osteoporosis/osteopenia does not compromise implant success, suggesting that dental implants remain a reliable treatment option for improving function and aesthetics in these patients.

Xerostomia and Burning Mouth Syndrome

The presence of estrogen receptors in the oral mucosa and salivary glands [8] causes symptoms in the oral tissues triggered by hormonal fluctuations during menopause. Additionally, microscopic similarities between the vaginal and buccal epithelia, such as keratinization patterns and lipid distribution, have been observed in postmenopausal women [44]. Multiple oral sensory disturbances, including xerostomia, taste disturbance and burning mouth have been reported in perimenopausal women [45]. It proves the significance of the relationship between menopause and oral mucosa discomfort.

Perimenopausal women often complain of dry sensation in the oral cavity, called xerostomia [1,2,45]. Xerostomia is a subjective sensation of dry mouth, while hyposalivation refers to objectively reduced salivary secretion [46,47]. Its causes range from autoimmune diseases like Sjögren syndrome to psychological stress, medications, and radiation therapy [45]. Menopause has been widely linked to xerostomia, significantly reducing quality of life. A study found that 79.5% of physicians and gynecologists encountered cases of xerostomia, taste disturbances, yet only 58.5% referred patients for specialized care, indicating that many affected women may not receive appropriate treatment [48]. There are many possible treatments that make the disease more manageable, such as saliva substitutes, mouth rinses, sugar-free candy, and pilocarpine [47].

Another condition often observed in postmenopausal women is Burning Mouth Syndrome (BMS) [49–51]. This disease is characterized by a burning sensation in the oral mucosa without any visible lesions. The pain, often described as burning, tingling, or scalding, typically affects the tongue, lips, and palate, worsening throughout the day [51]. The exact cause of BMS remains unclear, but hormonal changes, particularly the decline in estrogen levels during menopause, are believed to play a significant role. Several hypotheses suggest that estrogen deficiency may contribute to neuronal inflammation, alterations in the trigeminal nerve, or dysregulation of neuroactive steroids, leading to pain perception changes [49]. Additionally, changes in saliva composition, such as reduced flow and altered protein concentration, may impact oral lubrication and sensation [52]. The management of BMS includes antidepressants, benzodiazepines, as well as topical treatments like clonazepam [49,53]. HRT has shown mixed

results, with some studies reporting symptom relief in some patients. Psychotherapy is also considered beneficial for managing BMS-related anxiety and stress [53,54].

Conclusion

Menopause significantly influences oral health through microbiome alterations, increased periodontal disease susceptibility, and oral discomforts such as xerostomia and BMS. Additionally, osteoporosis treatments may contribute to BRONJ, posing challenges for surgical procedures. Awareness of these risks among healthcare professionals is crucial for early intervention and tailored treatment strategies to maintain optimal oral health in menopausal women.

Disclosure

Authors contribution:

Conceptualisation: Wiktoria Musyt
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