



ROLE OF PROGESTERONE IN ORAL HEALTH AND PROSTHODONTIC REHABILITATION IN GERIATRIC FEMALES

Dr. Megha Chopra^{1*} (BDS, MDS), Dr. Pankaj Dhawan² (BDS,
MDS), Dr. Harsimran Kaur³ (BDS, MDS)

Article History: Received: 22.05.2023

Revised: 05.06.2023

Accepted: 26.07.2023

Abstract

Various physiological changes are observed at specific phases of life in a women as there is a variation in the level of female sex hormones estrogen and progesterone. A significant influence is seen in the oral cavity especially in the gingival sulcus, periodontium and the alveolar bone. Oral health awareness in geriatric females is important to minimize these consequences. The rehabilitation process in geriatric females, thus requires a modified approach. A full clinical examination is required for complete evaluation prior beginning the prosthetic therapy. The further communication expressed here highlights geriatric females that constitute a significant group of patients who require special preventive and therapeutic care from clinicians in this period.

Keywords: Cytokines, Cantilever, Osteoporosis, Progesterone.

^{1*}Senior Lecturer, Department of Prosthodontics and Crown & Bridge, Faculty of Dental Sciences, MRIIRS, Faridabad, Haryana

²Professor and Head, Department of Prosthodontics and Crown & Bridge, Faculty of Dental Sciences, MRIIRS, Faridabad, Haryana

³Prosthodontist & Implantologist, Assistant Professor, Dept. of Dental Surgery, VMMC & Safdarjung Hospital, New Delhi

*Corresponding Author:

Dr. Megha Chopra^{1*} (BDS, MDS)

^{1*}Senior Lecturer, Department of Prosthodontics and Crown & Bridge, School of Dental Sciences, MRIIRS, Faridabad, Haryana

Email: ^{1*}drmeghachopra@gmail.com

DOI: 10.31838/ecb/2023.12.s3.757

1. Introduction

Progesterone produced by the ovaries is derived from the Latin word “*pro gestationem*” as it helps in transition of endometrium from a proliferative to the secretory stage, facilitating the nesting of blastocyst that is essential for the maintenance of the pregnancy. It is a cholesterol derivative that has ample purposes in the human body and also has a significant effect on oral tissues as the receptors for estrogen and progesterone have been confirmed in the gingiva, attached periodontium & periodontal fibroblasts and scattered fibroblasts of the lamina propria and osteoblasts indicative of a direct action of sex hormones on periodontal tissues.¹ Progesterone and estrogen directly or indirectly influence the cellular proliferation, differentiation and growth in target tissues.² The action of these hormones influences the cytodifferentiation of stratified squamous epithelium and the synthesis and maintenance of fibrous collagen is altered. Consequently, the effectiveness of the epithelial barrier to bacterial insult decreases. These hormones may alter immunologic factors and responses, including antigen expression and presentation, cytokine production as well as the expression of apoptotic factors and cell death. Progesterone specifically, stimulates the production of prostaglandin E2 followed by the deposition of polymorphonuclear leukocytes (PMNL's) in the gingival sulcus which consequently leads to the down regulation of IL-6 release by gingival fibroblasts in the oral cavity.³ The effect is also present in the microcirculatory system wherein; the endothelial cells and pericytes of venules are swollen, microthrombi are formed, and the disruption of mast cells and enhanced vascular proliferation is seen. The above events trigger the inflammatory response of the periodontal tissues which is observed at various junctures in the women life cycle, i.e; puberty, pregnancy and postmenopause.⁴

Progesterone: Influence on Oral Health

Geriatrics and specifically geriatric dentistry pertaining to females comprises of implementation of comprehensive preventive and tooth replacement dentistry protocols with many challenges.⁵ Women in the fifth decade (45-55 years) of their life stop producing estrogen and progesterone leading to the end of menstruation cycle giving rise to physiological

changes and a number of oral symptoms in an otherwise healthy women such as oral dryness, dysgeusia, altered pain tolerance, burning mouth syndrome, menopause associated osteoporosis, alveolar bone loss and low tolerance in the edentulous mouth to the removable prosthetic restorations usage. A variation in inflammatory mediators, and alteration in vascular permeability results in more plaque accumulation and a risk of advanced periodontitis.⁶ The dentist is often the first to appreciate numerous changes that are experienced in the oral cavity during menopause.⁴

Periodontal Health and Menopause

Lessened progesterone levels not only affects the amount of saliva secreted but also the composition. The level of steroid hormones reduces the intestinal absorption of calcium in the body. This further leads to an increase in serum parathyroid hormone levels (PTH). PTH is the hormone responsible for the regulation of calcium and phosphate metabolism in the body. This regulation results in an increased calcium release into blood serum and saliva.^{7,8} It has been observed that there is a lessened salivary flow rate (both stimulated and unstimulated) consequently leading to a reduction in the hydration of oral mucosa, thereby causing its thinning, friability, atrophic, decrease in elasticity and increased susceptibility to mechanical injuries.⁹ The use of removable prosthesis in such cases may often act as an irritant and frequent removal and placement can injure this thin mucosa.⁸

Postmenopausal Gingivostomatitis

The absence of hormones leads to worsened gingival health followed by periodontal disease and tooth loss. There is an alteration in taste sensation and many patients complain of metallic taste. The postmenopausal gingivitis is comparable to chronic desquamative gingivitis. According to a past study estrogen and progesterone deficiency leads to an increased immune reaction. Low production of estrogen with an increased production of interleukin 1, 6, 8, 10, tumour necrotic factor α , granulocyte colony stimulating factor inhibits the inflammatory cytokines expression. Consequently, there is bone resorption, more intense gingival inflammation, oral bone loss followed by clinical attachment loss and tooth loss.¹²

Burning Mouth Syndrome

Many geriatric women consistently report of pain/burning sensations in the oral mucosa, without any convincing explanation on examination. This condition known as the burning mouth syndrome can have a marked effect on the tongue, palate, buccal mucosa and the throat. Similar burning sensation is also reported beneath the denture bearing areas making it all the more difficult for a female to wear the prosthesis. Mukatash-Nimri in a clinical study on complete denture wearers on 129 patients (112 females where all the females had low estradiol and progesterone levels) for 6 months or more and had burning sensations, verified the location of burning sensation. Acrylic monomer allergy by patch testing and complete blood count was also done. The above denture elements acted as local factors that were associated with burning sensation as they all were significant so new prosthesis was fabricated for them and the symptoms were reduced in 35 out of the 64 patients.¹³

Xerostomia in Geriatrics

Saliva is a complex biological fluid that plays a vital role in the overall maintenance of the oral cavity. It helps in keeping the mouth moist at all the times, thus; helps in chewing, swallowing, taste perception and oral flora regulation. Xerostomia is a subjective feeling of dryness, most often caused by decreased salivation or when the salivary factor is normal, but there is a reduction in its components.¹⁴ Postmenopausal women have decreased unstimulated and stimulated sublingual and submandibular salivary gland secretions when compared to premenopausal women. The same is not related to any medication effect. Presence of concomitant systemic diseases in menopausal women such as diabetes, rheumatoid arthritis, Sjogrens syndrome and constant use of many medications increase the effect.¹⁵ Studies conducted by Mahesh et al.¹⁶, Rukmini et al.¹⁷, Kullander et al.¹⁸, and Foglio-Bonda et al.¹⁹ concluded a significant decrease in salivary flow rate during the menopausal period.

Reduced saliva secretion, which is the principal defense factor in the oral cavity, can lead to a number of problems, such as the higher occurrence of dental caries, oral infections,

dysphagia, taste disturbance, and increased sensitivity of the mucosa to mechanical injuries.⁶ In a complete denture patient it helps in the retention of denture as it forms a layer of saliva between the intaglio surface of the denture and the adjacent mucosa. Insufficient saliva can result in the disruption the microbial balance and pathogens such as *Candida Albicans* and *Streptococcus mutans* because the moist environment is also important for colonization and growth of microorganisms on oral surfaces.⁷ Mechanical trauma and other oral infections such as halitosis and discomfort are also experienced in xerostomia. It is advised to immerse the prosthesis in benzoic acid, chlorhexidine (0.12%) and sodium hypochlorite (1%). Soft denture liners and specialized dentures incorporating artificial saliva reservoir that exhibit slow, sustained and continuous release of salivary substitute should be a choice for such patients. For eg. Split denture technique in mandibular denture and liquid supported closed dentures.^{5,20}

Removable Prosthetics as a Rehabilitation Therapy: Modifications

The prosthetic restorations in edentulous or partially edentulous patients improves the overall oral-health related quality of life as demonstrated by several studies.²¹ Malnutrition is a common observation in at least 50% geriatrics as the persisting state gives rise to problems associated with chewing, or insufficient oral hygiene.²² Removable prosthodontics (in cases of partially edentulous arch) as a treatment plan requires thorough periodontal examination, i.e, gingival appearance, bleeding on probing, plaque deposits. For good prognosis and improved acceptance of prosthetic treatment participatory decision-making regarding prosthetic treatment should be done. In geriatric females where complete denture therapy is required psychological, anatomic and constructional factors have to be considered.²³ The prosthetic treatment in geriatric dentistry should be based on the g-3-S principle, i.e; simple, stable and solid. Considering the removable prosthetics attention has to be given to:

- The prosthesis should be easy to handle for patients.
- A stable design should be made to avoid fractures in case of accidental dropping.

- The prosthesis should be solid, implying that no dental problems are expected in near future after the completion of prosthetic treatment.

The prosthesis fabricated for geriatric females should be such that it can be modified easily in case of tooth loss or other biological complications. Thin mucosa as explained earlier makes the finishing and polishing of dentures important for better fit and function.⁵ Antifungal agents can be incorporated into the acrylic surface of the dentures as it will lessen the monomer irritation and chances of denture stomatitis. In the cases, where partial replacement of teeth is required, strict oral hygiene maintenance along with full mouth scaling and a tooth brush that is soft where brushing using “toe” or “heel” should be recommended.⁸ DeVan suggested preservation of the teeth left is more important than the replacement, thus; a hygienic design should be preferred that consists of a prosthesis that accumulates less plaque, allows minimal coverage of gingival margins with the denture connector and secondly providing appropriate relief at the margin between the denture and the gingiva. Extensive anatomic limitations such as alveolar yokes/plicae should be avoided.⁹

Treatment Planning in Completely Edentulous Patients

Complete dentures are still a successful provision even for patients with past prosthesis experience. The prognosis and success of a complete denture therapy depends on the application of fundamental prosthodontics applied for fabrication. The dentures should be well extended and balanced articulation should be achieved. Patients who are existing complete denture wearers and have proven successful can be given duplicate dentures.²⁴

Fixed Prosthetics as a Rehabilitation Therapy: Modifications

Resorption of the alveolar ridge is the main sequelae of the iatrogenic risk of rehabilitation with a removable prosthesis. Comparative evaluation of bone resorption in a study conducted by Ozan O et al, was higher in RPD wearing patients.²⁵ Open embrasures with spacing of at least 2mm between the mucosa and alveolar ridge should be the ideal design of a fixed partial denture. It permits mechanical

cleansing of the under surface along with the inter-proximal surfaces of the pontics. In reduced dentition presentations a distally extending cantilever can act as a favorable alternative.²⁶ Shortened Dental Arch (SDA) concept has marked excellent results in geriatric females. It avoids extensive restorations in replacing molars in clinical settings with typically ten occluding antagonistic pairs.²⁷

Menopause Associated Osteoporosis and Implant Supported Rehabilitation

Low progesterone levels also leads to reduced Bone Mineral Density (BMD). When this BMD level falls below 2.5, it leads to a reduction in bone mass or osteoporosis. In geriatric women with progesterone deficiency, there is a net systemic bone resorption followed by a loss in trabecular bone structure, loss of skeletal strength and ultimately bone fracture. Thus, the bone loss is attributed to the low circulating levels of 17 β -estradiol that alters the mechanism of bone resorption and formation. Osteoporosis has been associated with an increased rate of tooth loss, periodontal disease and loss of bone density.^{28, 29}

Nowadays, with the predictability of osseointegration the dental implants are being widely used to replace missing teeth and stabilize complete removable prostheses. The major advantage of implants is that they preserve alveolar bone and an increase in bite force when compared to conventional complete dentures.³⁰ Patients suffering from debilitating diseases such as poorly controlled diabetes mellitus, blood dyscrasias, less immunity are unsuitable for implant placement. The planning for the same in a post menopause female is a complex procedure and the same should commence with placement of implant via a surgical guide fabricated post measurement of cortical bone thickness using CBCT. A study conducted by Chun Ko Y to study the correlation of menopausal age and thickness of the cortical bone at the planned implant site concluded that the posterior and anterior mandible region in the geriatric females had highest thickness and density. The posterior maxilla region, had the lowest bone density. Vitamin D, calcium, smoking and alcohol abuse are other parallel factors that have a marked effect on bone metabolism.³¹ Delayed loading should be the ideal protocol for the placement of prosthesis, paying specific attention on the

torque analysis at the time of implant insertion. Diverse implant surface modifications such as bio activated, drug loaded or chemically treated that can enhance contact bone formation and osseointegration can be chosen.³² Implant-retained prostheses, another treatment modality has been a major advance in the treatment of patients with denture wearing difficulties, and offer the possibility of overcoming many of the problems associated with conventional replacement dentures. Implant retained mandibular overdentures should be considered as the first choice of treatment in edentulous patients.³² Meticulous oral hygiene maintenance including regular proper biofilm and plaque removal should be advised.

Hormone Replacement Therapy (HRT) For Menopause

Alveolar bone responds readily to external influences and undergoes physiological changes, thus the maintenance of alveolar bone should be the solitary aim before planning any rehabilitation therapy in a geriatric female. Hormone Replacement Therapy (HRT) is considered as a rational approach for management of menopause associated osteoporosis. This therapy is used to boost the hormonal levels and relieve some symptoms of low estrogen and progesterone levels. However, the risks associated with the usage of hormone therapy published in the Women's Health Initiative (WHI) findings in 2002 and 2004 have questioned its utility. It depends on the type of hormone therapy, the dose and the duration for which the medication is taken. The risks of the same include heart disease, stroke, blood clots, increased chances of gall bladder/gallstones, increased risk of dementia and breast cancer. Hormone replacement therapy can be used in cases where there is a need to prevent bone loss such as in the cases of postmenopausal osteoporosis. Periodontal disease also known as a "silent disease" without the women even realizing, advances to Stage 4 where the periodontitis is severe. The clinical significance of HRT and its relation in periodontal health regimen is not well recognized. A study conducted by Stavroglou in 2020, showed that the periodontitis symptoms disappeared after about 6 months from the beginning of HRT.³³ This therapy controls the amount of breakdown of periodontal tissue by down regulation of matrix metalloproteinase (MMP-8 and MMP-13) and

cytokines. The doctors usually recommend medications such as Bisphosphonates to treat the same. The risk of tooth loss was also lessened in women who used HRT than those who did not. This therapy may help if a female can't tolerate or aren't benefitting from other treatments.³⁴

2. Conclusion

Aging is a natural process and this should be viewed as a normal and inevitable biological phenomenon. The estrogen and progesterone release is decreased as a woman progresses through certain stages in her reproductive life cycle, negatively impacting the oral mucosa and the periodontal tissues. Addressing these gender-specific oral health issues is of paramount importance to healthcare professionals. A complete medical history followed by thorough intra oral examination of the mucosa, periodontium and dental condition of the remaining teeth, monitoring salivary flow both stimulated and unstimulated should be the standard protocol before beginning any required rehabilitation. The role of hormone therapy (HT) in reversal of oral symptoms is still controversial. Randomized controlled trials and long-term follow ups are required to evaluate and establish the effect of hormone therapy considering oral health parameters.

3. References

1. Cable JK, Grider MH. Physiology, Progesterone. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan. 2022 May 8. PMID: 32644386.
2. Amar S, Chung KM. Influence of hormonal variation on the periodontium in women. *Periodontol 2000*. 1994; 6:79–87.
3. Lapp CA, Thomas ME, Lewis JB. Modulation by progesterone of interleukin-6 production by gingival fibroblasts. *J Periodontol*. 1995; 66:279–84.
4. Prasanna JS, Karunakar P, Sravya MV, Madhavi B, Manasa A. Detrimental consequences of women life cycle on the oral cavity. *J Oral Res Rev* 2018; 10(1): 39-44. DOI: 10.4103/jorr.jorr_33_17.
5. Nitschke I, Wendland A, Weber S, Jockusch J, Lethaus B, Hahnel S. Considerations for the Prosthetic Dental Treatment of Geriatric Patients in

- Germany. *J Clin Med* 2021; Jan; 10(2): 304. doi: [10.3390/jcm10020304](https://doi.org/10.3390/jcm10020304)
6. Ciesielska A, Kusiak A, Ossowska A, Grzybowska ME. Changes in the Oral Cavity in Menopausal Women- A Narrative Review. *Int J Environ Res Public Health*, 2022; 19, 253. Doi: [10.3390/ijerph19010253](https://doi.org/10.3390/ijerph19010253).
 7. Srebrzyńska-Witek A., Koszowski R. Effect of menopause on salivary glands and oral mucosa. *Przegląd Menopauzalny*. 2013;5: 423–428. doi: 10.5114/pm.2013.38598.
 8. Fiyaz M., Ramesh A., Ramalingam K., Thomas B., Shetty S., Prakash P. Association of salivary calcium, phosphate, pH and flow rate on oral health: A study on 90 subjects. *J. Indian Soc. Periodontol*. 2013; 17:454–460. doi: 10.4103/0972-124X.118316.
 9. Kumar S, Gupta P. Clinical Implications of Xerostomia in Geriatric Population. *Int J Contemp Med Res*. 2018; 5(3): C25-C29.
 10. Picos AM, Donca V, Picos A. Prosthetic Rehabilitation in Partially Edentulous Elders- A Case Report. *Clujul Med*. 2014; 87(3): 203–206. Doi: [10.15386/cjmed-340](https://doi.org/10.15386/cjmed-340).
 11. Krall EA, Dawson-Hughes B, Hannan MT, Wilson PW, Kiel DP. Postmenopausal estrogen replacement and tooth retention. *Am J Med* 1997; 102:536-42.
 12. Massler M. Oral manifestations during the female climacteric (the postmenopausal syndrome). *Oral Surg Oral Med Oral Pathol* 1951; 4: 1234-43.
 13. Mukatash-Nimri GE, Al-Nimri MA, Al-Jadeed OG, Al-Zobe ZR, Aburumman KK, Masarwa NA. Patients with Burning Mouth Sensations. A Clinical Investigation of Causative Factors in a Group of “Complete Denture Wearers” Jordanian Population. *Saudi Dent J*. 2017 Jan; 29(1): 24–28. doi: [10.1016/j.sdentj.2016.10.002](https://doi.org/10.1016/j.sdentj.2016.10.002)
 14. Meurman J.H., Tarkkila L., Tiitinen A. The menopause and oral health. *Maturitas*. 2009; 63:56–62. Doi: 10.1016/j.maturitas.2009.02.009.
 15. Friedlander A.H. The physiology, medical management and oral implications of menopause. *J. Am. Dent. Assoc.* 2002; 133: 73–81.
 16. Mahesh D.R., Komali G., Jayanthi K., Dinesh D., Saikavitha T.V., Preeti D. Evaluation of Salivary Flow Rate, pH and Buffer in Pre, Post & Post-Menopausal Women on HRT. *J. Clin. Diagn. Res.* 2014; 8:233–236.
 17. Rukmini J.N., Sachan R., Sibi N., Meghana A., Malar C.I. Effect of Menopause on Saliva and Dental Health. *J. Int. Soc. Prev. Community Dent.* 2018; 8: 529–533. Doi: 10.4103/jispcd.JISPCD_68_18.
 18. Kullander S., Sonesson B. Studies on saliva in menstruating, pregnant and postmenopausal women. *Act. Endocrinol.* 1965; 48: 329–336.
 19. Foglio-Bonda P.L., Rocchetti V., Nardella A., Fantinato M., Sandhu K., Foglio-Bonda A. Salivary pH and flow rate in menopausal women. *Eur. Rev. Med. Pharmacol. Sci.* 2019; 23: 918–922.
 20. Bikash P, Seema P. Prosthetic Rehabilitation of a Xerostomia Patient with a Mandibular Split Salivary Reservoir Denture. *Annals and Essences of Dentistry*, 2010; 2 (3): 32-35.
 21. McGrath C, Bedi R. Can dentures improve the quality of life of those who have experienced considerable tooth loss? *J. Dent.* 2001; 29:243–246. Doi: 10.1016/S0300-5712(00)00063-4.
 22. O’Keeffe M.O., Kelly M., O’Herlihy E., O’Toole P.W., Kearney P.M., Timmons S., O’Shea E., Stanton C., Hickson M., Rolland Y., et al. Potentially modifiable determinants of malnutrition in older adults: A systematic review. *Clin. Nutr.* 2019; 38:2477–2498. Doi: 10.1016/j.clnu.2018.12.007.
 23. Volkert D., Beck A.M., Cederholm T., Cereda E., Cruz-Jentof A., Goisser S., De Groot L., Großhauser F., Kiesswetter E., Norman K., et al. Management of malnutrition in older patients—Current approaches, evidence and open questions. *J. Clin. Med.* 2019; 8:974. Doi: 10.3390/jcm8070974.
 24. Jithin GN, Amalorpavan, Sreelal T, Mohan A, Chnadramohan G, Hines AJ. Geriatric Care in Prosthodontics. *J Pros Impl Dent*; 2019, 2(2): 61-65.
 25. Ozan O, Orhan K, Aksoy S, Icen M, Bilecenoglu B, Sakul BU. The Effect of Removable Partial Dentures on Alveolar Bone Resorption: A Retrospective Study with Cone-Beam Computed Tomography. *J Prosthodont*, 2012; 1-7.
 26. Allen PF, McKenna G, Creugers N. Prosthodontic Care for Elderly Patients.

- Dent Update, 2011, Sep; 38(7):460-2, 465-6, 469-70. Doi: 10.12968/denu.2011.38.7.460.
27. Gerritsen AE, Witter DJ, J Creugers NH. Long-Term follow up indicates unimpaired oral health-related quality of life for people having shortened dental arches. *J Dent.* 2017 Oct; 65:41-44. Doi: 10.1016/j.jdent.2017.06.011.
 28. North American Menopause Society (2010). Management of Osteoporosis in Postmenopausal Women. *Menopause*, 17(1): 25-54. doi:10.1097/gme.0b013e3181c617e6
 29. Mutneja P, Dhawan P, Raina A, Sharma G. Menopause and the Oral cavity. *Indian J Endocrinology Metab.* 2012; 16 (4): 548-551.
 30. Khalid Shah F, Gebreel A, Hamed Elshokouki A, Ali Habib A, Porwal A. Comparison of immediate complete denture, tooth and implant-supported overdenture on vertical dimension and muscle activity. *J Adv Prosthodont.* 2012 May; 4(2): 61–71.
 31. Chun Ko Y, Tzu Tsai M, Jyh Fuh L, Jia Tsai M, Hui Wang X, Li Huang H, Ting Hsu J. Association Between Age of Menopause and Thickness of Crestal Cortical Bone at Dental Implant Site: A Cross-Sectional Observational Study. *Int J Environ Res Public Health* 2020; 17 (16): 5868. Doi: [10.3390/ijerph17165868](https://doi.org/10.3390/ijerph17165868).
 32. D'haese, Matthys C, Sahak H, Besseler J, Bruyn HD. Implant-retained mandibular overdentures: Patient-related outcome measurements after seven years of function. *Dent J (Basel)*. 2022 May; 10(5): 88.
 33. Stavroglou A, Tsikouras P, Grapsa A, Trypsiannis G, Bothou A, Anthoulaki X, Koutsogiannis M, Nikolettos N, Galazios G, Drossos G, Tsaroucha A. The Contribution of Hormone Replacement Therapy in Postmenopausal Women to Prevent Periodontal Disease. *J Women's Health Dev* 2020; 3 (2): 135-147.
 34. Pizzo G, Guiglia R, Licata ME, Pizzo I, Davis JM, Giuliana G. Effect of Hormone Replacement Therapy (HRT) on Periodontal Status of Postmenopausal Women. *Med Sci Monit*, 2011; 17(4): PH23-27