

Polypharmacy and Oral Health among the Elderly

Abdulsamet T¹, Mehmet S. Dogan^{2*}, Fatih D³, Izzet Y²

¹Faculty of Dentistry, Department of Periodontology, Dicle University, Diyarbakir, Turkey

²Faculty of Dentistry, Department of Paediatric Dentistry, Dicle University, Diyarbakir, Turkey

³Nuh Cimento Sanayi Vakfi Oral Health Center, Kocaeli, Turkey

Received: April 13, 2016; Accepted: April 25, 2016; Published: May 02, 2016

***Corresponding author:** Mehmet Sinan Dogan, Department of Paediatric Dentistry, Faculty of Dentistry, Dicle University, School of Dentistry, Diyarbakir, 21280, Turkey, E-mail: dtlider@hotmail.com

Abstract

Over the age of 65 populations is constantly increasing in the past 50 years. The elderly population is exploding. This is based on the fact that the living conditions of this population is improving, as well as individual and community health, and advances in sanitation. Elderly have the highest medication use in the world compared to other segments of the population. The goal of the medication use is to treat diseases and to make them feel better, which increases their quality of life. Over use of some medications has become a public health problem. Multiple drug use (Polypharmacy), causes an increase in the risk of side effects and interaction between drugs, treatment costs, hospitalization requirements, rates of incompatibility to medical treatment and resulting problems. The purpose of the scientific evidence of the literature can represent information and reviews based on polypharmacy during dental treatment to emphasize the importance of the recognition of the risks. As a result, periodontal disease, dental caries and xerostomia may be linked to complications associated with multiple drug use in the elderly.

Keywords: Polypharmacy; Oral health; Dental caries; Oral diseases; Elderly population

Introduction

Aging does not have a clear definition. It can be defined in different ways such as biological, physiological, emotional and functional aging. Biological aging is defined as the changes in the structure and functions in human body depending on aging, whereas physiological aging can be defined as personal and behavioural changes that occur as a result of biological changes. Find something more recent than 1998 from world health report of World Health Organization (WHO), defines aging as increasing of disabilities and dependency on others. In another definition, it is the deterioration of ability of the person for adapting to the changing environment and the capacity of organism in ensuring balance between internal and external factors, as well as an increase in the possibility of death, depending on time. Aging is briefly a continuing and universal process observed in all living things which causes decline in all functions [1,2].

In the twentieth century, in line with the developments in medicine, science and technology, the increase in world

population accelerated. With the existing population increase projection it is estimated the world will be home to 8.909 billion people in 2050. Due to the extension of life expectancy and decrease in birth rate, the world is aging more rapidly than the previous 50 years [2].

Elderly population is constantly increasing in the past 50 years on a global scale. According to WHO, the number of people over the age of 65 will increase by 85% in the next 25 years, and working population will increase by 45 percent. As of 2015 901 million people are at the age of 60 or above, which makes 12% of the world population Figure 1. Over the age of 65 populations is increased by 3.26% on an annual basis. Over the age of 65 population is expected to reach 1.4 billion in 2030 and 2.1 billion in 2050 [3]. The most important reasons for this increase are the decrease in infant and child deaths, achievements in vaccination and health conditions and sustainability thereof as well as development of antibiotics. However, the fundamental factor is the decrease in mortality, not only in infants and children but in all age groups. Another reason is that people are exceeding the age of 65 which is life expectancy. For this reason, it is expected that welfare of elderly people will be found in the list of problems with priority in the areas with increase in the following years [4].

With aging, deceleration and degeneration can be witnessed in system functions as a result of the changes in human body. Because of age or associated conditions, level of absorption, blood flow and emission of basal and stimulated stomach acid decreases in gastrointestinal system. Absorption can also be affected in the elderly as a result of using multiple medicines simultaneously. For example, congestive heart failure, which is one of the most frequently seen diseases in the group of 65 and above, decreases blood flow and affects absorption negatively. This particular age group, the increase in keratinize cells on the skin and decrease in skin hydration can cause changes in the absorption of medicines applied on the skin. It is reported that usually the absorbed amount remains unchanged but the absorption speed changes. In addition, total amount of water and lean body weight decreases but body/fat ratio increases especially in individuals over the age of 75. For this reason, the distribution volumes of medicines with

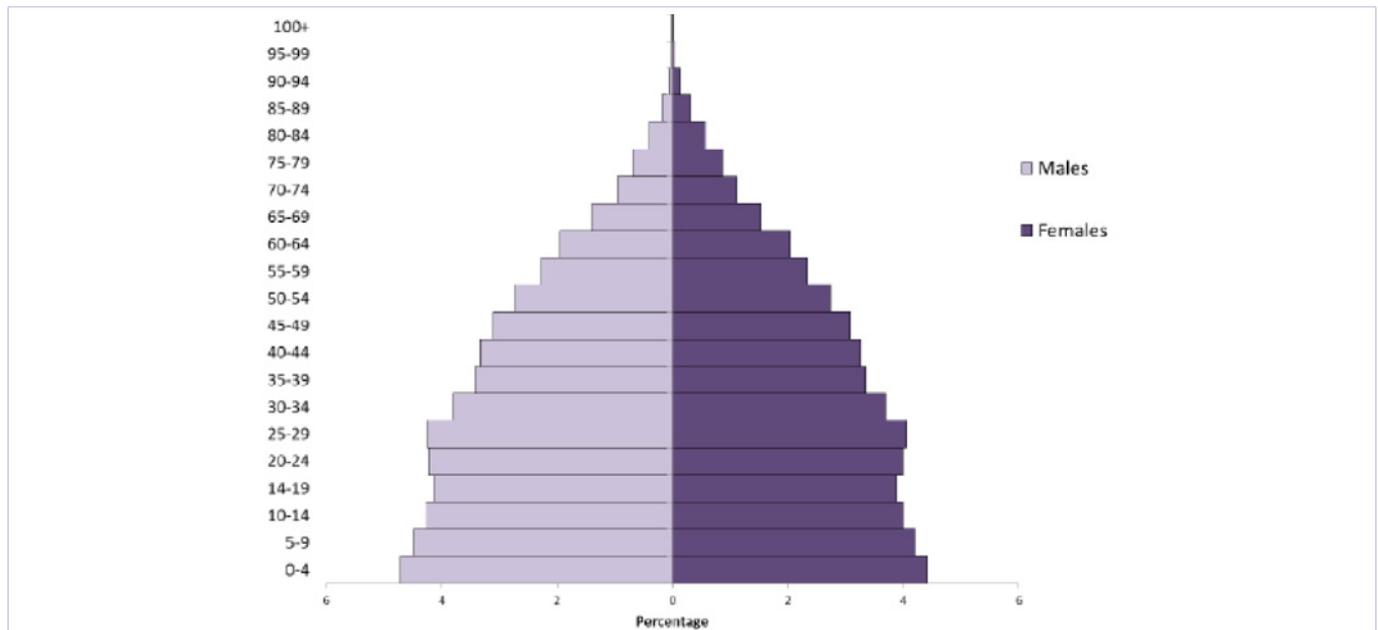


Figure 1: Distribution of the world's population by age and sex, 2015.

Source: United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision. New York: United Nations.

high solubility in fats increases while the distribution volumes of hydrophilic medicines decreases compared to young individuals [5].

With aging, total plasma protein remains unchanged but decrease is observed in albumin fraction. As most medicines are bound by albumin, due to decreased albumin concentration in elderly people, more free medicines are seen in the plasma. With decreased albumin concentration, the probability of side effects increases in the elderly due to joint usage of multiple medicines, which is valid especially for salicylates, anticoagulants and oral hypoglycemic which are bound to protein at high rates and frequently used by the elderly. Care is needed for using multiple medicines with the elderly with malnutrition or lowered plasma proteins due to chronic diseases as such [6].

As a result of increase in the rise in prevalence of chronic diseases, elderly are increasingly obliged to use more medicines. Pharmacokinetic features of medicines are changing with age. The response given to the medicines depending on the changes in their absorption, distribution in the body, metabolisms, excretions and changes in receptor level, show differences in elderly people [7].

Polypharmacy

Although there is no consensus on the definition of polypharmacy, which defines multiple usage of medicines in the elderly, usually indicates to the usage of several medicines simultaneously for multiple indications [8,9]. Literature review shows that several different definitions are used for polypharmacy [8].

Previous studies show that number of prescribed medicines increases with aging [10]. Polypharmacy causes an increase in the risk of side effects and interaction between medicines, treatment costs, hospitalization requirements, rates of incompatibility to medical treatment and resulting problems [11].

A study in United Kingdom showed that 36% of the people aged over 75 took 4 or more medicines. This is related to the polypharmacy which tends to increase with age. Another study conducted in the USA on 2500 respondents showed that polypharmacy was witnessed mostly in females over the age of 65, 23% of whom took at least 5 medicines, and 12% of whom used more than 10 medicines [9,12]. Another study performed in the USA by Qato, et al. on 3005 respondents found that 35-40% of the people between the ages of 75 and 85 used 5 medicines, which was the lowest figure [13].

Kutsal, et al. conducted a study on polypharmacy in 2006 based on face-to-face interviews with 1433 people at and over the age of 65 and found out that 84.7% of the respondents were regularly using at least one medicine and 15.3% were not. 23.2% of the respondents stated that they used only one medicine, 17% stated that they used two medicines, 19.2% stated that they used three medicines, and 38.2% stated that they used four and more medicines [6].

The group of medicines which has most side effects on the elderly is the medicines which cause central neural system depression, followed by antibiotics, analgesics, anticoagulants, anti-hypertensions, bronchodilators, diuretics and oral hypoglycemic agents. The findings which indicate side effect of medicine can be listed as follows: depression, confusion,

anxiety, falling, loss of memory, extrapyramidal system findings, constipation and incognisance [14,15].

Oral Health in the Elderly

With aging, changes in oral cavity and peripheral tissues play a critical role. With aging, important changes are witnessed such as decrease in saliva flow rate, increase in loss of teeth, tooth caries, changes in temporomandibular joints, atrophy in oral mucosa and muscles. These structural changes cause differentiation in chewing functions and thus nutrition habits.

Nutrition disorders allow for several pathological changes to occur. Changes in mastication system, regular age-dependent physiological changes and sometimes metabolic disorders can emerge as pathological changes that affect oral tissues. Tooth caries and periodontal diseases in the elderly also emerge as serious health problems [16,17].

With aging, physiological erosion occurs in the enamels. As a result of these erosions it takes a dark yellowish colour with secondary formation. Dentin tissue of the tooth thickens and its composition changes. With aging, cellular elements, veins, nerves and lymphatic functions in the pulp of the tooth decrease whereas collagen fibres proliferate. In the cement structure of the tooth, thickening called Hypercementosis occurs due to calcification [18, 19].

With aging, gum and periodontal ligament cell count and collagen synthesis decreases. Periodontal ligament becomes thinner, atherosclerosis develops in alveolar bone and periodontal ligament veins. Frequent gingival recession is witnessed in elderly people. Clinical crown length of the teeth increases and the risk of caries formation in the cementum structure opening to oral environment rises. With aging gingival epithelium becomes thinner and keratin tissue increases. In addition, increase is reported in the cellular density [19].

With aging, increase in tooth losses is witnessed more due to periodontal diseases than tooth caries. With the decrease in the number of teeth, chewing functions also decline. For this reason, individuals tend to consume soft food. In this case, if oral hygiene is not adequate, material and bacterial plaque accumulates rapidly, as a result of which metabolic diseases, infections, medication, and root caries, which may result in halitosis. It is witnessed that the strength and frequency of periodontal diseases increase with aging. With aging, it is accepted that the main destruction in periodontal tissues occurs as a result of several pathological changes instead of physiological aging [20, 21].

The integrity of alveolar bone depends on the existence of teeth [22]. Loss of teeth and prosthesis usage increases loss of alveolar bones. In case of excessive resorption in mandibular, bone crest takes the shape of a knife which makes usage of total prosthesis impossible. As resorption increases, foramen mentale emerges which results in aching and paraesthesia. Loss of all mandibular teeth decreases the vertical size of elderly people. The control functions of orbicularis oris muscles deteriorate. As a result, coronoid protrusion shrinks, condylar grows and

prognathism develops in the mandibular. This situation in elderly patients may cause decline in face and lips, oral contraction and wrinkles starting from the corners of lips [19].

Oral mucosal diseases are more frequently witnessed in elderly patients compared to young patients. It is reported that there is a positive relation between aging and oral mucosa diseases [23]. Mucosal pathologies of elderly population mostly develop as a function of oral findings of systematic diseases, malnutrition, side effects of medicines, oral infections and mechanical trauma. However, the major reason is mostly drinking and smoking and long-term prosthesis usage [24, 25].

In histological studies conducted, it is seen that parenchyma of salivary glands is replaced by fatty tissue with aging, which increases the flow rate of saliva [26]. As glands have different reservoir capacities functionally, the decrease in the flow rate of saliva is not identical. Decrease in saliva flow rate is an indication of dehydration in the elderly population. When loss of water cannot be prevented in the elderly, aging accelerates, skin dries, oral xerophthalmia and ophthalmological xerostomia develops. Xerostomia has such clinical symptoms as mouth dryness, change in taste, difficulty in swallowing and speech [27,28]. Insufficient saliva decreases the adhesion of prosthesis and negatively affects chewing, swallowing and speech functions. Such factors as eroded tooth surfaces, erroneous restorations, excessive tension and relaxation in chewing muscles and bruxism creates changes in occlusal surfaces of teeth and leads to the deterioration of closing position of mandibular and maxilla teeth. For this reason, temporomandibular joint pathologies become more frequent with aging. The frequency of temporomandibular joint pathologies increases by 33 to 86% in the elderly people [19].

The Impact of Polypharmacy on Oral and Dental Health

The purpose of medication is to make sure that the disease of the elderly are healed and that he/she feels better. However, whether necessary or not, polypharmacy leads to the occurrence of some problems. The problems related to polypharmacy can be listed as side effects of the medicines, medicine-medicine interactions, increased medical expenses, medicine unconformities, increased hospitalization and medication mistakes [11].

In addition to the physiological effects of aging, systematic diseases and medicines used for their treatment and radiotherapy can result in xerostomia. Sreebny and Schwartz report that 80 percent of the widely prescribed medicines cause xerostomia and more than 500 medicines lead to saliva gland dysfunction as a side effect [29].

In addition to aging, polypharmacy plays an essential role xerostomia and the change in flow rate of saliva. It is beyond discussion that side effects of several medicines for people who take psychotropic, anti-hypertension and diuretic medicines serve as an etiological factor in the change in saliva flow rate. The information in the literature on the change in the flow rate

of saliva, medicine consumption and oral symptoms in elderly people support this view [30,31].

Saliva activities host anti-caries impact as well as antifungal, physical and immunological protection for oral and gastrointestinal mucosa. Changes in the quality and amount of saliva might cause distorted oral function and dryness of oral mucosa such as disorder, gingivitis, dental plaque formation, tooth caries, traumatic lesions due to prosthesis, and in total fungus infection which can impair the life quality of the person [32].

Pharmacotherapy very often leads to xerostomia; especially in long-term treatments due to tricyclic antidepressants, opioids, antihistamines and anti arrhythmic agents anti-cholinergic effects, it causes decrease in the flow rate and amount of saliva [33,34].

Anticonvulsants (Phenytoin, valproic acid and Phenobarbital) which are frequently used in old age are employed in the treatment of grand mal, temporal lobe and physic-motor syncope. Calcium canal blockers (Nifedipine, Diltiazem, Isradipine, Felodipine, Amlodipine and Verapamil) are used in patients with antihypertension, especially angina or peripheral vascular diseases. Immunosuppressant (Cyclosporine A (CsA)) is a very strong immunosuppressive agent used for preventing the refusal of transplanted organ and the treatment of a host of autoimmune cases such as rheumatoid arthritis. Elder patients who take these medicines can suffer from gingival enlargement depending on the usage of the medicine. Gingival hypertrophy caused by treated systemic case, age of patients, usage of other medicines simultaneously, uncontrolled periodontal disease and some other factors [35,36].

In all three groups, gingival enlargement starts mostly at interdental papillary without painlessly but affects the entire free and adherent gingival. As the enlargement progresses, the gingival margins can cover the entire tooth surface. Enlargement usually affects the labial surfaces of maxilla and mandibular. Gingival enlargements vary between 88% and 80% in a number of studies. The dose of the medicine, its usage period, serum concentrations, age of the patient, oral hygiene, level of inflammation at gums and genetic tendency have impact on gingival enlargement. Usually enlargement stops in toothless areas and after the medication is stopped [37,38].

Bisphosphonates which are usually used at later ages for treatment of osteoporosis, breast cancer and prostate cancer impede osteoclasts which are among bone cells and impede bone resorption; thus, osseous modulation stops and the bone tissue cannot be renewed. This process results in the removal of aged bone and failure of formation of new bone continues with the death of osteocytes and cumulative accumulation occurs in bone matrix, as a result of which a totally necrotic bone tissue emerges [39]. The first bisphosphonate-related osteonecrosis phenomenon at jaws was reported in 2003. It is more frequent at mandibular depending on the less blood building [40].

One reason of temporomandibular joint disorder is such medicines as venlafaxine, paroxetine which are among selective serotonin reuptake inhibitors from antidepressant medicine group. Development of bruxism is reported after using these medicines [41].

Some studies maintain that anti-inflammatory and corticosteroid medicines used in the treatment of rheumatoid arthritis, which is a chronic inflammatory disease, inhibit periodontal tissue destruction and suppress gingival inflammation [42].

As a result of immunosuppressants used at older age's Herpes simplex, Varicella Zoster, cytomegalovirus and oral candidal infections develop in oral mucosa. In addition, as a result of polypharmacy, medical reactions such as Lupus Erythematosus, Pemphigus, Lichenoid, Allergic stomatitis, Erythema multiforme can be witnessed as well as hemorrhage, Gingival Hyperplasia, changes in taste, colour change in teeth. Pigmentation and angioedema contact stomatitis can develop after using chlorhexidine mouthwashes, antibiotics and anaesthetics.

Conclusion

Periodontal disease, dental caries, lesions in the oral mucosa and xerostomy can be complications associated with polypharmacy among the elderly. It is crucial that the health professional presents the proper knowledge in order to conduct the dental appointment among the elderly patients to avoid the risk of complications during clinical procedures and post-operative recovery.

References

- Basara BB, Mollahaliloglu S, Pulgat E, Sahin Kavuncubasi. Gender and Residency Effects on Elderly Health in Turkey. *Ageing International*. 2014;39(1):55-67.
- Seyhan T, Aysin K, ilknuri B. Systematic Changes in the Elderly, Disease and the Role of the Nurse. *Akad Geriatri*. 2012;4:1-11.
- Akgün S, Coskum L, Budakoğlu İ. Elderly population trends in the world and in Turkey, problems and suggestions for improvements. *Journal of Geriatrics*. 2004;7(2):105-510.
- United Nations Population Division, World Population Prospects: The 2015. Revision Population Database; Available form: http://esa.un.org/unpd/wpp/Publications/Files/WPP2015_Volume-II-Demographic-Profiles.pdf.
- Asma S, Gerekliglu Ç, Korur AP, Ahmet Ferit Erdoğan. Multidrug use in the Elderly Patients with Multimorbidity: A Great Problem in Family Medicine. *Turkish Journal of Family Medicine & Primary Care*. 2014;8(1):8-12. doi: 10.5455/tjfm.47042.
- Gökçe Kutsal Y. Polypharmacy in elderly. *Turk J Geriatr*. 2006;Special issue:37-44.
- Arslan Ş, Atalay A, Gökçe-Kutsal Y. Drug use in Elderly. *Turk J Geriatr*. 2000;3(2):56-60.
- Wyles H, Rehman HU. Inappropriate polypharmacy in the elderly. *Eur J Intern Med*. 2005;16(5):311-313.
- Yeşil Y, Cankurtaran M, Kuyumcu M. E. Polifarmasi. *Clinical Development*. 2012;25:18-23.

10. Klopotoska J E., Wierenga PC, Stuijt CC, Arisz L, Dijkgraaf MG, Kuks PF et al. Adverse drug events in older hospitalized patients: results and reliability of a comprehensive and structured identification strategy. *PLoS One*. 2013;8(8):e71045. doi: 10.1371/journal.pone.0071045.
11. Da Silva Carneiro SC, Azevedo-e-silva MC, Ramos-e-silva M. Drug eruptions in the elderly. *Clin dermatol*. 2011;29(1):43-48. doi: 10.1016/j.clindermatol.2010.07.006.
12. Bahat G, Tufan F, Bahat Z, Tufan A, Aydin Y, Akpınar TS et al. Comorbidities, polypharmacy, functionality and nutritional status in Turkish community-dwelling female elderly. *Aging clinical and experimental research*, 2014;26(3):255-259. doi: 10.1007/s40520-014-0229-8.
13. Qato DM, Alexander GC, Conti RM, Johnson M, Schumm P, Lindau ST. Use of prescription and over-the-counter medications and dietary supplements among older adults in the United States. *JAMA*. 2008;300(24):2867-2878.
14. Nguyen J, Fouts M, Kotabe SE, Lo E. Polypharmacy as a risk factor for adverse drug reactions in geriatric nursing home residents. *Am J Geriatr Pharmacother*. 2006;4(1):36-41.
15. Nobili A, Licata G, Salerno F, Pasina L, Tettamanti M, Franchi C, et al. Polypharmacy, length of hospital stay, and in-hospital mortality among elderly patients in internal medicine wards. The REPOSI study. *Eur J Clin Pharmacol*. 2011;67(5):507-519. doi: 10.1007/s00228-010-0977-0.
16. Tham R, & Hardy S. Oral healthcare issues in rural residential aged care services in Victoria, Australia. *Gerodontology*. 2013;30(2):126-132. doi: 10.1111/j.1741-2358.2012.00652.x.
17. Eltas A, Altun O, Yavuzer D, Dedeoğlu N, Assessment with radiography of tooth loss and alveolar bone resorption in elderly. *Cumhuriyet Dent J*. 2012;15(2):109-117.
18. Raja BK, Radha G, Rekha R, S.K Pallavi. Geriatric Oral Health: A Literature. *Int J Dent Health Sci*. 2015;2(2):385-395.
19. Onem E, Tuğsel E.Z.Changes in Chewing System With Aging .Istanbul University Faculty of Dentistry Journal. 2012;46(2):58-65.
20. Unsal B. Oral and dental health in elderly, Gazi University Faculty of Dentistry Journal, 2002;19(1):45-49.
21. Kısa S, & Zeyneloğlu S. Inpatient Postpartum Women's Status of Oral Hygiene Habits and Visit to The Dentist during Their Most Recent Pregnancy. *TAF Prev Med Bull*. 2013;12(1):65-74.
22. Nazliel HE, Hersek N, Ozbek M, Karaagaoglu E.Oral health status in a group of the elderly population residing at home. *Gerodontology*. 2012;29(2):e761-e767.
23. Jainkittivong A, Aneksuk V, Langlais RP. Oral mucosal lesions in denture wearers. *Gerodontology*. 2010;27(1):26-32.
24. Dundar N, and Kal B I. Oral mucosal conditions and risk factors among elderly in a Turkish school of dentistry. *Gerontology*. 2007;53(3):165-172.
25. Cebeci AR, Gulsahi A, Kamburoglu K, Orhan BK, et al. Prevalence and distribution of oral mucosal lesions in an adult Turkish population. *Med Oral Patol Oral Cir Bucal*, 2009;14(6): E272-E277.
26. aDe Almeida, P. D. V., Gregio, A. M., Machado M. A., De Lima A. A., Azevedo L. R. Saliva composition and functions: a comprehensive review. *J Contemp Dent Pract*. 2008;9(3):1-11.
27. Turner M,Ship JA. Dry mouth and its effects on the oral health of elderly people. *J Am Dent Assoc*, 2007;138Suppl:15-20.
28. Mortazavi H, Baharvand M, Movahhedian A, M Mohammadi, A Khodadoustan. A Xerostomia due to systemic disease: a review of 20 conditions and mechanisms. *Ann med health Sci Res*. 2014;4(4):503-510.
29. Hassona Y, Scully C. Salivary changes in oral mucosal diseases. *Periodontology 2000*. 2016;70(1):111-127.
30. Enoki K, Matsuda K I, Ikebe K, Shunsuke Murai, Minoru Yoshida, Yoshinobu Maeda, et al. Influence of xerostomia on oral health-related quality of life in the elderly: a 5-year longitudinal study. *Oral surgery, oral medicine, oral pathology and oral radiology*. 2014;117(6):716-721.
31. Luiz A. G., Marie. S. M. S., Jair C. L. Impact of ageing and drug consumption on oral health. *Gerodontology*. 2009;26(4):297-301.
32. Villa A, Nordio F, & Gohel A. A risk prediction model for xerostomia: a retrospective cohort study. *Gerodontology*. 2015; doi: 10.1111/ger.12214.
33. Gil-Montoya JA, de Mello ALF, Barrios R, Gonzalez-Moles, Bravo M. Oral health in the elderly patient and its impact on general well-being: a nonsystematic review. *Clin Interv Aging*. 2015;10:461-467.
34. Johanson CN, Österberg T, Lernfelt B, Downen Birkhed. Salivary secretion and drug treatment in four 70-year-old Swedish cohorts during a period of 30 years. *Gerodontology*. 2015;32(3):202-210.
35. Bharti V, & Bansal C. Drug-induced gingival overgrowth: The nemesis of gingiva unravelled. *Journal of Indian Society of Periodontology*. 2013;17(2):182-187.
36. Kazancıoğlu H. O, Erişen M, Demirtaş N , et. al. Drug Induced Gingival Overgrowth and Its Management. *Istanbul University Faculty of Dentistry Journal*. 2013;47(1):66-72.
37. Arya R, & Gulati S. Phenytoin-induced gingival overgrowth. *Acta Neurologica Scandinavica*. 2012;125(3):149-155.
38. Subramani T, Rathnavelu V, Yeap SK, Noorjahan Banu Alitheen. Influence of mast cells in drug-induced gingival overgrowth. *Mediators of inflammation*. 2013;2013, doi: http://dx.doi.org/10.1155/2013/275172.
39. Carranza FA, Klokkevold PR. Immunity and Inflammation: Basic Concepts .Newman MG, Takei HH, Carranza FA, editors. *Clinical Periodontology*. Philadelphia: W.B. Saunders Comp., 2007:209-227.
40. Chiandussi S, Biasotto M, Dore F, Cavalli F, Cova MA, Di Lenarda R. Clinical and diagnostic imaging of bisphosphonate-associated osteonecrosis of the jaws. *Dentomaxillofac Radiol*. 2006;35(4):236-243.
41. Balasubramaniam R, Klasser GD, Cistulli P, Gilles J, Lavigne. The link between sleep bruxism, sleep disordered breathing and temporomandibular disorders: an evidence-based review. *J Dent Sleep Med*, 2014;1(1):27-37.
42. Bıyıkoğlu B, Buduneli N, Kardeşler L, Aksu K, Öder G, Kütükçüler N. Evaluation of t-PA, PA-2, IL-1 α , and PGE2 in gingival crevicular fluid of rheumatoid arthritis patients with periodontal disease. *J Clin Periodontol*. 2006;33(9):605-611.s