**RESEARCH**
O&G Forum 2024; 34 – 3s: 763-768

# ASSESSMENT OF ORAL HEALTH STATUS IN ELDERLY PATIENTS ON POLYPHARMACY

**Vignesh P[1], Dr. Shilpa Shyam[2], Dr. Dhanvanth.M[3]**
[1] Research Associate, Dental Research Cell, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, Tamil Nadu, India. vpvignesh519@gmail.com
[2] Senior Lecturer, Department of Oral medicine and Radiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Poonamallee High Road, Chennai, Tamil Nadu, India. shilpaskottoor@gmail.com
[3] Senior Lecturer, Department of Oral Medicine and Radiology, Priyadarshini Dental College and Hospital, Tiruvallur, Tamil Nadu, India

**Abstract**
**Background:** The oral health status of elderly adults has implications for general health problems. Polypharmacy for elderly adults is associated with an increased risk of potentially inappropriate medicines and many adverse drug events; however, no report has shown that polypharmacy itself is associated with complex oral problems.
**Aim:** This study aimed to determine the association between polypharmacy and oral health status in patients admitted to the recovery and rehabilitation ward.
**Materials and Methods:** This cross-sectional study included 100 patients aged between 40-70. Oral health status was analyzed using various indices like OHIS, Plaque index, gingival index, DMFT.Cases of patients taking medications were defined as polypharmacy and were categorized. Logistic regression analysis was performed to examine the relationship between polypharmacy and oral health status.
**Results:** This study examined the oral health status of individuals in different age groups and their medication intake, presented as percentages out of 100 population. In the 40-50 age group, 20% took 1 medication, 12% took 2-3 medications, 9% took 4-5 medications, and 4% took more than 5 medications. Similarly, in the 50-60 age group, 15% took 1 medication, 17% took 2-3 medications, 10% took 4-5 medications, and 3% took more than 5 medications. Notably, in the 60-70 age group, no individuals took 1 medication, 5% took 2-3 medications, 4% took 4-5 medications, and 2% took more than 5 medications. Indices for assessing oral health were evaluated across medication intake groups. In the oral hygiene index, varying distributions were observed: from individuals taking 1 medication, 2% had good scores, 8% had fair scores, and 9% had poor scores. The plaque index showed differing levels of plaque accumulation, with percentages varying across medication intake groups. For instance, from individuals taking 1 medication, 3% had excellent plaque scores, while 15% had good scores, 13% had fair scores, and 3% had poor scores. Gingival health, as assessed by the gingival index, exhibited varying degrees of inflammation across medication intake groups. Finally, DMFT scores indicated different levels of dental caries experience, with varying percentages in different score ranges across medication intake groups.
**Conclusion:** Focusing on the number of medications may be helpful in detecting oral problems. These findings underscore the need for tailored interventions to address the oral health needs of elderly patients on polypharmacy.
Keyword: Oral health, Elderly patients, Polypharmacy, Healthcare utilization, Preventive strategies.

## INTRODUCTION

Early diagnosis and treatment of diseases have led to longer life expectancy. How- ever, the treatments of these diseases involve pharmacologic agents, and as people age, they develop multiple health ailments, which can lead to polypharmacy. There are age-related changes in the systems of the body, which alter the pharmacokinetics and pharmacodynamics of medications and make the elderly more vulnerable to adverse events. A major side effect of medications is the qualitative and quantitative change of the cause in saliva (salivary hypofunction), by their anticholinergic effects.

(1,2)Saliva plays a pivotal role in the homeostasis of the oral cavity because of its protective and functional properties, which include facilitating speech, swallowing, enhancing taste, buffering and neutralizing intrinsic and extrinsic acid, remineralizing teeth, maintaining the oral mucosal health, preventing overgrowth of noxious microorganisms and xerostomia. With salivary hypofunction, a plethora of complications arise, resulting in decreased quality of life in the elderly. However, the anticholinergic effects of medications can be overcome, and the oral cavity can be restored to normalcy.(3) Apart from their therapeutic effect, pharmacologic agents also bind to other un- wanted potential sites causing side effects that affect the central nervous system (CNS) and/or the peripheral nervous system. Central side effects include confusion/ disorientation, hallucinations, sleepiness, clumsiness or unsteadiness, convulsions, mental status/behavior changes such as distress, excitement, nervousness, attention deficits, cognitive decline (memory loss), and delirium. (4,5)Peripheral side effects of medications can be salivary hypofunction, difficulty in speech and swallowing, mucous membrane dryness of the nose and skin, blurred vision, light sensitivity, increased breathing

difficulty, difficulty urinating, bloating, and constipation in older adults.(6,7)

The perception of dry mouth has been reported to be directly proportional to the to- tal number of drugs taken per day. Dry.org reports 1800 drugs in 80 drug classes that have the capacity to induce xerostomia. Because there are more new medications in the pipeline in production to cure and treat diseases, the list of salivary hypofunctions- inducing medications will only increase.(6,8,9)

Polypharmacy, which refers to the use of a combination of multiple drugs, has received much attention in recent years. Epidemiological study has indicated that approximately half of the elderly adult population is subjected to polypharmacy. Polypharmacy is a critical problem for elderly adults because it decreases medication adherence,6 and increases both healthcare costs and the risk of adverse drug events, such as falls and fractures, cognitive decline, drug-induced Parkinsonism and potentially inappropriate medicines (PIMs).Some medications cause side effects that appear to be symptoms of poor oral health, such as dry mouth, oral ulcers and taste disorders. (7,10,11)Thus, it is important to focus on oral problems based on the specific type of drug used. While the relationship between types of drugs and oral problems has been thoroughly investigated, the relationship between polypharmacy and complex oral problems has not been established. Thus, this study aimed to determine the association between polypharmacy and oral health status of elderly patients admitted to the recovery and rehabilitation ward.(12)

## MATERIALS AND METHODS

### Study Design:

This study employed a cross-sectional design to investigate the oral health status of elderly patients in relation to their medication intake. Ethical approval was obtained from the Saveetha Dental College Research Ethics Committee prior to data collection.

### Participants:

A total of 100 elderly individuals aged 40-70 years were recruited from Saveetha dental college. Participants were stratified into three age groups: 40-50 years, 50-60 years, and 60-70 years, with 100 participants in each group.

### Data Collection:

Data on medication intake and oral health indices were collected through structured interviews and clinical examinations conducted by trained dental professionals. Medication intake was assessed based on self-reported information regarding the number of medications currently being taken by each participant.

### Oral Health Indices:

1. Oral Hygiene Index (OHI): Participants oral hygiene status was evaluated using the OHI, which assesses plaque accumulation and gingival health. Scores were categorized as good, fair, or poor based on predetermined criteria.
2. Plaque Index: Plaque accumulation was assessed using the Plaque Index, which categorizes plaque scores as excellent, good, fair, or poor.
3. Gingival Index: Gingival health was assessed using the Gingival Index, which categorizes gingival inflammation as absence, mild, moderate, or severe.
4. DMFT Score: Dental caries experience was assessed using the DMFT index, which quantifies the number of decayed, missing, and filled teeth. Scores were categorized into ranges (1-9, 10-19, and 20-28) to indicate low, moderate, and high caries experience, respectively.

### Data Analysis:

Data were analyzed using statistical software SPSS. Descriptive statistics, including frequencies, percentages and standard deviations, were used to summarize participants' characteristics and oral health indices.

### Ethical Considerations:

Informed consent was obtained from all participants prior to their inclusion in the study. Confidentiality of participants' data was maintained throughout the study process, and participants were assured of their right to withdraw from the study at any time without repercussions.

## RESULTS

The study investigated the oral health status of elderly patients across different age groups and their corresponding medication intake. In the 40-50 age group, varying medication intake was observed: 20% of them took 1 medication, 12% of them took 2-3 medications, 9% of them took 4-5 medications, and 4% of them took more than 5 medications. Similarly, in the 50-60 age group, medication intake varied with 15% of them taking 1 medication, 17% of them took 2-3 medications, 10% of them took 4-5 medications, and 3% of them took more than 5 medications. Notably, in the 60-70 age group, medication intake showed a decline, with no individuals taking 1 medication, 5% of them took 2-3 medications, 4% of them took 4-5 medications, and 2% of them took more than 5 medications. (Figure 1)

The study examined various indices to assess oral health status among elderly patients on polypharmacy, focusing on oral hygiene, plaque accumulation, gingival health, and DMFT scores.

### Oral Hygiene Index (OHI)

- Among individuals taking 1 medication, the distribution of OHI scores showed 2% with good scores, 8% with fair scores, and 9% with poor scores. This suggests a varied but generally suboptimal oral hygiene status in this group.
- As medication intake increased, similar trends were observed, with more individuals having fair to poor OHI scores.
- Notably, individuals taking 4-5 medications had a higher proportion of poor OHI scores compared to those taking fewer medications, indicating a potential negative impact of polypharmacy on oral hygiene practices. (Figure 2)

### Plaque Index

- Analysis of plaque accumulation revealed varying levels of plaque among different medication intake groups.
- Individuals taking 1 medication showed a mix of plaque scores, with some having excellent or good scores but a notable portion having fair to poor scores.
- However, as medication intake increased, there was a trend towards poorer plaque scores, particularly among those taking 4-5 medications and more than 5 medications.
- This suggests a potential association between polypharmacy and increased plaque accumulation, which can contribute to oral health problems such as caries and periodontal disease. (Figure 3)

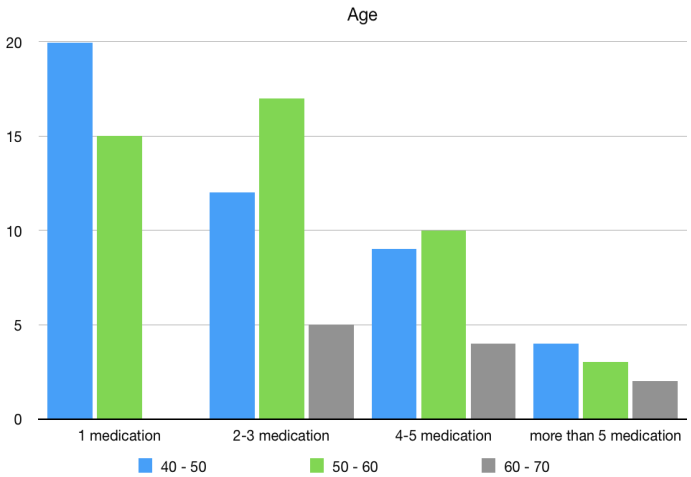
**Gingival Index**

- Gingival health assessment showed varying degrees of inflammation among different medication intake groups.
- Individuals taking 1 medication exhibited a range of gingival health statuses, from absence of inflammation to severe inflammation.
- As medication intake increased, there was a notable increase in the prevalence and severity of gingival inflammation, particularly among those taking 4-5 medications and more than 5 medications.
- This indicates a potential link between polypharmacy and gingival inflammation, which is a common manifestation of periodontal disease and can lead to further oral health complications if left untreated. (Figure 4)

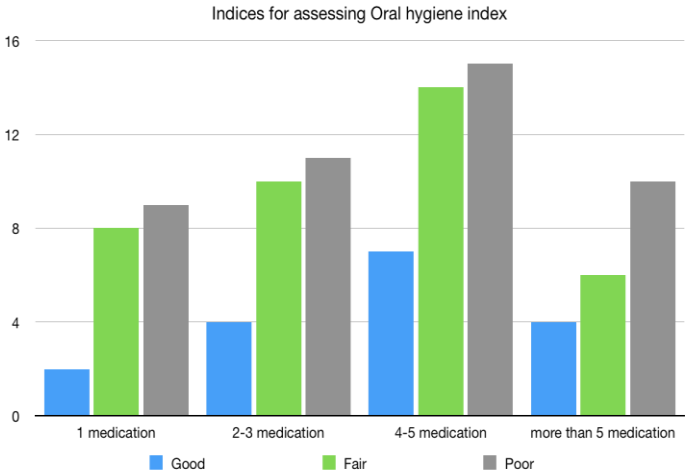
**DMFT**

- The DMFT score, which assesses dental caries experience, showed varying levels of dental caries among different medication intake groups.
- Individuals taking 1 medication exhibited a range of DMFT scores, with some having low scores (indicating fewer caries) and others having higher scores (indicating more caries).
- Interestingly, individuals taking 4-5 medications had a higher proportion of individuals with higher DMFT scores, suggesting a potential association between polypharmacy and increased risk of dental caries.
- Similarly, individuals taking more than 5 medications showed a higher prevalence of higher DMFT scores, indicating a potential cumulative effect of polypharmacy on dental caries experience. (Figure 5)

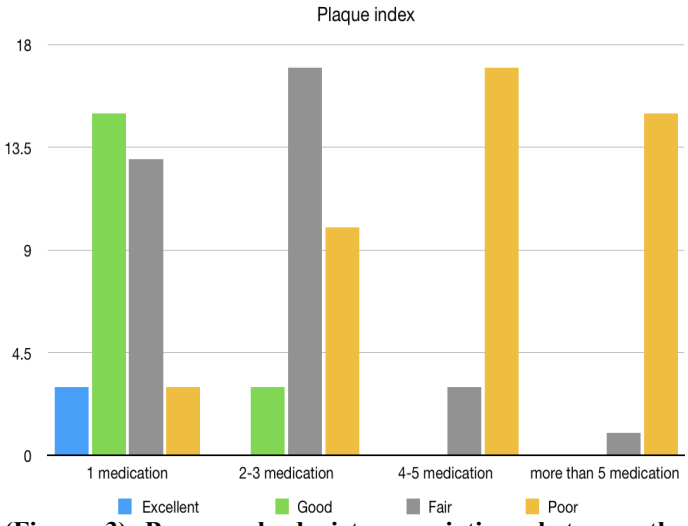
In summary, the study findings suggest that polypharmacy may have a detrimental impact on various aspects of oral health, including oral hygiene, plaque accumulation, gingival health, and dental caries experience. These findings underscore the importance of comprehensive oral health assessments and tailored interventions for elderly patients on polypharmacy to mitigate oral health complications and improve overall well-being.



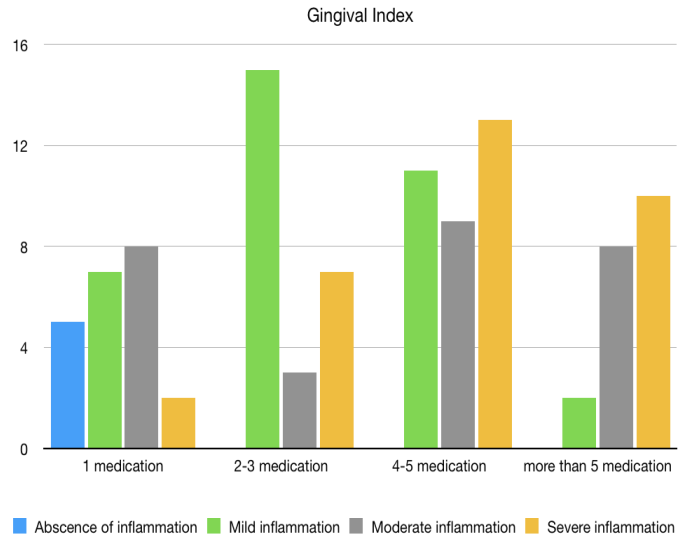

**(Figure 1) Bar graph depicts associations between the number of medications taken and age.**



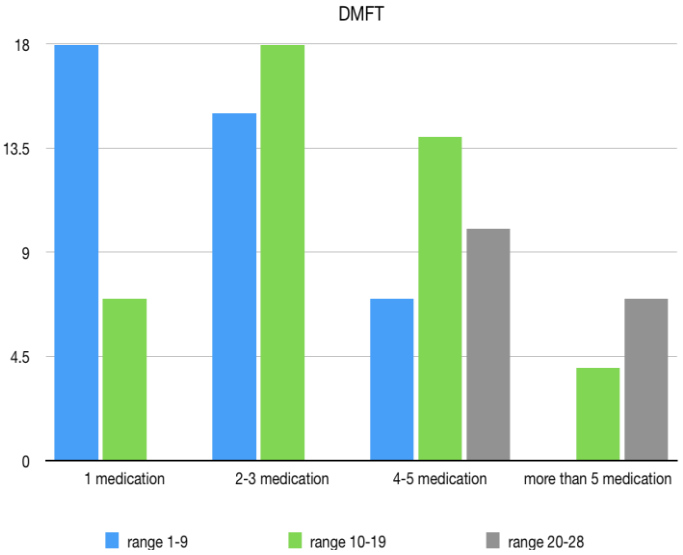

**(Figure 2) Bar graph depicts associations between the number of medications taken and OHIS.**




**(Figure 3) Bar graph depicts associations between the number of medications taken and Plaque index.**




**(Figure 4) Bar graph depicts associations between the number of medications taken and gingival index.**




**(Figure 5) Bar graph depicts associations between the number of medications taken and DMFT score.**

## DISCUSSION

The prevalence of elderly patients with poor oral health in this study was like that of previous studies. Notably, this study revealed that polypharmacy was independently associated with poor oral health status, even after adjusting for age, sex, BMI, chronic disease, cognitive function and motor function in Model 1. The crude model showed that poor oral health status was associated with age, BMI, cognitive function, motor function and polypharmacy, which is consistent with the results of previous studies.(13,14) Oral problems are caused by lack of oral self-care and irregular visits to the dentist, for reasons other than oral cavity conditions, such as dry mouth, cavities and periodontal disease. Elderly patients, particularly, exhibit a decreased capacity for oral self- care, due to physical deterioration related to aging and disease, malnutrition, cognitive and psychological factors, and socioeconomic factors.(15),(16),(17),Moreover, elderly patients with low ADL have decreased oral management capacity, and consequently have more oral problems. Age and the decline in ADL lead to fewer dental visits, which are, hence, more likely to cause oral problems. Other studies have also reported a correlation between frailty and oral health status, measured using the OHAT. It is also worth noting that the association between frailty and polypharmacy in elderly patients is long recognized. In summary, patients who are subject to polypharmacy might be less able to take care of themselves and engage in fewer dental visits, resulting in worsen- ing of their natural teeth and general oral hygiene. This study revealed that polypharmacy was associated with "Natural teeth" and "Oral cleanliness."(18),(19),(20) Polypharmacy was also shown to be independently associated with oral problems, even if cognitive and motor functions were considered as confounding factors. This result suggested that factors other than frailty might influence the association between polypharmacy and poor oral health.(21)

Previous studies investigated the association between oral health status and frailty but did not consider the impact of drug treatment. In response to this, we considered the effects of the PIMs-DM themselves in adjusted Model 2. As a result, there was an independent association exhibited even after adjusting for medications of which dry mouth is a side effect, according to the Japanese guidelines. In other words, "quantitative" polypharmacy itself was associated with poor oral health status, even after con- trolling for the effects of "qualitative" drug types. As "Saliva" and "Natural teeth" were associated with polypharmacy in this study, dry mouth may be a strong factor affecting the association between poor oral health status and polypharmacy. Increasing the quantity of drugs aggravates dry mouth and might result in the inside of an oral cavity to deteriorate (22) .Previous research has suggested an association between the number of medications taken and dry mouth. This is particularly applicable to anticho- linergics, which were included in the PIMs-DM of this study. When anticholinergics attach themselves to receptors, particularly M3 receptors in the salivary glands, changes in the cell membrane inhibit salivary flow. In the case of elderly patients, the anticholinergic effect is enhanced and the anticholinergic load increases cumulatively, due to multiple medications and age-related changes in pharmacokinetics. Regarding this effect, there were many other drugs with anticholinergic effects, other than the PIMs-DM in this study.(23–28)

## CONCLUSION

The findings of this study provide valuable insights into the oral health status of elderly patients in relation to polypharmacy. The analysis revealed several key observations regarding medication intake and its association with various oral health indices. Firstly, there was a noticeable trend of increasing medication intake with advancing age, particularly among individuals aged 50-60 years and 60-70 years. This highlights the prevalence of polypharmacy among elderly populations and the potential implications for oral health. Secondly, the study identified significant correlations between medication intake and oral health outcomes. Specifically, as the number of medications increased, there was a consistent deterioration in oral hygiene, plaque accumulation, gingival health, and dental caries experience. These findings suggest that polypharmacy may contribute to poor oral health outcomes among elderly patients. Furthermore, the observed patterns of oral health indices across different medication intake categories underscore the need for tailored interventions to address the unique oral health needs of elderly patients on polypharmacy. Preventive strategies aimed at promoting optimal oral hygiene practices, reducing plaque accumulation, and managing gingival inflammation should be prioritized in this population.

In conclusion, This study indicates that focusing on the number of medications taken and severity of the oral health of the early polypharmacy patients In addition, an appropriate reduction or change in medications may lead to a reduction in not only oral problems, but also other adverse effects.

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