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ORIGINAL ARTICLE

Effect of prolonged hospitalization on the maintenance of oral health: A self-report survey

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Abstract

Objectives: This study aims to evaluate the effect of prolonged hospitalization on the maintenance of dental health and to assess the nursing staff's approach to addressing these concerns.

Methods: A survey questionnaire explored changes in the routine dental care of patients hospitalized for over a month. The involvement of nursing staff in addressing dental care was also evaluated.

Results: Fifty adult patients aged 18–89 years (mean age 62.4 ± 20.54 years), 27 (54%) males, completed the survey. During hospitalization (mean 58.59 ± 38.63 days) 26% and 18%, increased consumption of sweets and sugary beverages, between meals, respectively; 26% and 20% of the patients reduced the frequency of tooth brushing in the morning and in the evening, respectively, and 42.2% of them, reduced the quality of their toothbrushing during hospitalization. Nevertheless, 95.9% and 93.9% of them were never instructed during hospitalization to limit their consumption of sweets and sugary beverages and 83.3% and 62.5% of them had never been reminded or offered assistance during hospitalization in performing toothbrushing, respectively. The lower frequency of morning toothbrushing was significantly correlated with a lack of nurses' assistance ($p = 0.004$). In contrast, 62.6% reported they were reminded every day to shower. Patients in the rehabilitation and geriatrics departments reported a greater need for a brush/toothpaste ($p < 0.0001$) and assistance in toothbrushing ($p < 0.0001$).

Conclusions: Prolonged hospitalization leads to significant deterioration in inpatients' dental health maintenance. Raising awareness among nurses regarding their inpatient's oral health maintenance is warranted. Providing patients with toothbrushes, toothpaste and educational materials upon hospitalization is recommended.

KEYWORDS

fermentable carbohydrates, frequency of eating, nurses, oral health, Oral hygiene, sugary drinks

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1 | INTRODUCTION

The maintenance of dental health includes the meticulous practice of several daily preventive measures: avoiding frequent consumption of carbohydrates (sugary drinks and food) between meals and tooth brushing twice a day with fluoridated dentifrices.[1–7] The rationale behind these recommendations is that frequent consumption of fermentable carbohydrates (more than six per day) is associated with an increased duration of demineralization of tooth substance, decreased duration of remineralization and as a result, increased caries development.[8,9]

The duration of the demineralization process following fermentable carbohydrate consumption depends also on the age of the accumulated plaque. In the absence of plaque, demineralization typically lasts around 30 min. However, when old, pathogenic plaque is present, the decrease in pH can continue for several hours.[8] Prolonged accumulation of old plaque not only leads to caries development but also contributes to the development of periodontal disease, which has been linked to various systemic conditions (e.g., diabetes, cardiovascular, endocrine, gastrointestinal diseases) as well as adverse medical outcomes like aspiration pneumonia and even with memory loss and confusion.[10–14] As individuals age, their susceptibility to these diseases increase due to changes in their immune system.[15]

Patients who are hospitalized for a prolonged period face challenges in maintaining their oral health, due to mobility issues and a lower priority placed on oral care. This can be manifested by the increased number of carbohydrates consumed between meals (including food and drinks) and reduced frequency of toothbrushing.[16] Additionally, patients with co-existing medical conditions often take multiple medications such as opioids, diuretics, steroids, antidepressants, antihistamines and oxygen, which can cause dry mouth[17,18] and increase the risk of developing caries and periodontal diseases.

Considering that oral health is closely linked to overall health and well-being it should be considered an essential part of nursing care. Unfortunately, oral care is often considered a low priority in hospitals, due to competing demands. Oral care is usually not discussed in nursing care plans and it is documented only when obvious oral problems arise.[19] Consequently, the quality and frequency of oral care provided to hospitalized patients vary, depending on the awareness and knowledge of the nursing staff.[16] Interestingly, it was shown that nurses who prioritize their patients' oral health, also tend to have better knowledge of its association with oral and systemic diseases and practice good oral hygiene themselves.[20] Various other barriers to improving oral care in hospitals include a lack of toothbrushes and toothpaste.[20]

Moreover, previous studies evaluating attitudes of nurses in hospitals towards dental health have often overlooked the impact of prolonged hospitalization on adult patients, had only evaluated this subject from the viewpoint of the nurses and most of them mainly focused on toothbrushing.[21,24–26] This aspect is significant since a decline in oral hygiene over time can have a permanent impact on dental and overall health, particularly in older patients who may already have compromised dental health. The null hypothesis of our study posits that during prolonged hospitalization, patients would increase their commitment to maintaining dental health and the nursing staff would be more actively involved in promoting oral hygiene.

The present study has two primary objectives

1. To assess the impact of prolonged hospitalization on the maintenance of dental health preventive measures, including tooth brushing and reduced consumption of sugary drinks and food between meals, from the perspective of the patients.
2. To evaluate the awareness and involvement of the nursing staff regarding the importance of maintaining oral hygiene during prolonged hospitalization from the patient's viewpoint.

2 | STUDY POPULATION AND METHODOLOGY

The study was conducted in a tertiary hospital in the geriatrics, rehabilitation, neurology, or orthopaedics inpatient departments, between April 2022 and February 2023. Fifty patients who were hospitalized for more than 1 month were offered to participate by anonymously completing a questionnaire regarding alteration in the maintenance of dental health during hospitalization and the involvement of the nursing staff in this responsibility. Filling out the questionnaire was considered informed consent.

Before the study, the questionnaire was reviewed by five experts in the field of dentistry (the authors WS, TN, LO, SS, MA). Every comment by one of the authors was discussed by all the authors and reached a consensus for comprehensiveness, consistency of measures, clarity, feasibility, ease of completion and responsiveness.[27]

The variables in the questionnaire included demographic data (such as sex and age); inpatient department; changes in the patient's frequency of consuming fermentable carbohydrates (sweets and sugary drinks) between meals during hospitalization as compared to the period before hospitalization and alteration in their oral hygiene habits (decreased frequency of toothbrushing in the morning and evening as compared to the period before hospitalization). In addition, the questionnaire included questions about whether they received/cancelled dental treatment during hospitalization or had a need for urgent dental care (Tables 1–3).

The questionnaires were given to the patients by two hygienists (SW, NT) after they visited their inpatient department to provide toothbrushing instruction. The patients returned them anonymously into a pool of returned questionnaires, without any intervention from the hygienists or the medical staff. The Institutional Review Board of our institution (Research number 8195-21-SMC) approved the study.

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TABLE 1 Distribution of answers regarding the effect of hospitalization on changes in the frequency of consuming a cariogenic diet.

Questions	Variables	Number	%
Do you eat more times a day sweet, snacks (such as cakes, cookies, waffles, biscuits, pretzels, potato chips, cornflakes, etc.) between meals during hospitalization?	1–2 times more	5	10.0
	3–4 times more	3	6.0
	Mostly sweets	1	2.0
	I consume a similar frequency as at home	30	60.0
	Fewer times a day during hospitalization	11	22.0
Do you drink more times a day sugary/carbonated/juices/soda between meals during hospitalization?	1–2 times more	7	14.0
	3–4 times more	4	8.0
	I consume mostly sugary drinks	2	4.0
	I consume a similar frequency as at home	35	70.0
	Fewer times a day during hospitalization	2	4.0

2.1 | Statistical analyses

The categorical variables were compared using the Chi-squared test or Fisher's exact test (where the numbers were small). Correlations between variables were examined using Kendall correlations, due to many ties and tested for significance. Associations between variables were tested by the Chi-squared test (or Fisher's exact test). In all tests performed, $p < 0.05$ was considered statistically significant. Statistical analyses were performed using R (version 3.4.1; R Foundation for Statistical Computing, Vienna, Austria).

3 | RESULTS

3.1 | Demographic and clinical characteristics of the patients

Fifty adult patients aged 18–89 years (mean age 62.8 ± 20.54 years, range 18–89 years), of which 27 (54%) were male (the male-to-female ratio was 1.32:1) (p = NS) completed the questionnaire (100% response rate). The patients were hospitalized mean 58.59 ± 38.63 days in the in-patient departments of geriatrics (25 patients, 51.0%), rehabilitation (12 patients, 24.5%), neurology (four patients, 8.2%), or orthopaedics (eight patients, 16.3%), data regarding the inpatient department of one patient was missing. Most of them did not suffer from alteration in taste (85.4%) or from oral ulcers (93.8%) during hospitalization.

3.2 | Changes in the frequency of consuming carbohydrates and drinking sugary drinks between meals during hospitalization

As depicted in Table 1, 26% and 18%, of the patients, respectively, reported an increased frequency of sugary drinks and sweets/snacks consumption between meals during hospitalization. These changes were not correlated to the age of the patients ($p = 0.858$) or the inpatient department ($p = 0.529$).

3.3 | Deterioration in the frequency and quality of toothbrushing during hospitalization

As depicted in Table 2, 45 (90%) and 383 (76%) of the patients reported that at home they brushed their teeth every day in the morning, and in the evening, respectively. Women brushed their teeth more often than men, in the morning ($p = 0.048$). However, this difference vanished during hospitalization ($p = 0.2$). During hospitalization, 26% and 20% of the patients reported reducing the frequency of tooth brushing both in the morning and in the evening, respectively, and 42.2% of them, reduced the quality of their toothbrushing during hospitalization.

A positive correlation was found between the frequencies of tooth brushing at home in the morning and in the evening ($p = 0.010$, correlation coefficient (CC) = 0.363) and tooth brushing during hospitalization ($p < 0.0001$, CC = 0.597).

Patients who did not change their tooth brushing frequency in the morning during hospitalization reported more often that they had to cancel an appointment with the dentist during hospitalization, compared to patients who reported a decrease or increase in their toothbrushing frequency during hospitalization ($p = 0.035$).

The patients who reported a higher frequency of tooth brushing during hospitalization also more often claimed that they did not need to be supplied with a toothbrush or toothpaste.

3.4 | The effect of patients' age on changes in their frequency of tooth brushing

Older patients brushed their teeth in the evening during hospitalization significantly more often than younger patients ($p = 0.030$,

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TABLE 2 Distribution of answers regarding alteration in the frequency and quality of toothbrushing during hospitalization.

Questions	Variables	Count	*N* %
How many times a week did you brush your teeth in the morning at home?	0.00	1	2.0
	1.00	1	2.0
	2.00	0	0
	3.00	2	4.0
	4.00	1	2.0
	5.00	0	0
	6.00	0	0
	7.00	45	90.0
How many times a week do you brush your teeth in the morning during hospitalization?	0.00	6	12.2
	1.00	1	2.0
	2.00	0	0
	3.00	5	10.2
	4.00	1	2.0
	5.00	3	6.1
	6.00	0	0
	7.00	33	67.3
How many times a week did you brush your teeth in the evening at home?	0.00	6	12.0
	1.00	0	0
	2.00	0	0
	3.00	4	8.0
	4.00	1	2.0
	5.00	1	2.0
	6.00	0	0
	7.00	38	76.0
How many times a week do you brush your teeth in the evening during hospitalization?	0.00	13	26.5
	1.00	1	2.0
	2.00	0	0
	3.00	3	6.1
	4.00	1	2.0
	5.00	1	2.0
	6.00	0	0
	7.00	30	61.2
Why do you brush your teeth during hospitalization with less frequency?	Not important	3	15.8
	I forget	4	21.1
	Brushing is painful	2	10.5
	Mouth has soars	1	5.3
	I do not have a brush	1	5.3
	I need assistance	8	42.1
Did you change your toothbrushing technique during hospitalization?	Yes, I do not have toothpaste	2	4.4
	Yes, I used a different toothbrush	1	2.2
	Yes, I brush for a shorter time	8	17.8
	No, I brush the same way as at home	23	51.1
	Yes, I pay more attention to toothbrushing during hospitalization	2	4.4
	Yes, I need assistance with toothbrushing	9	20.0

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CC = 0.317). No other statistical correlations were found between the age of the patients and their frequency of tooth brushing at home or during hospitalization.

3.5 | Effect of the duration of hospitalization on the frequency of toothbrushing

No statistical correlation was found between the duration of hospitalization and the frequency of toothbrushing during the hospitalization in the morning or the evening ($p = 0.347$ and $p = 0.720$, respectively).

3.6 | Factors influencing the reduction in tooth brushing frequency during hospitalization

The degree of reduced tooth brushing frequency during hospitalization in the morning or in the evening was not statistically related to any of the following variables: age ($p = 0.851$, $p = 0.767$), gender ($p = 0.423$ and $p = 0.979$, respectively), duration of hospitalization ($p = 0.491$, $p = 0.505$), time of last check-up ($p = 0.343$ and $p = 1$, respectively) or number of previous dental treatments ($p = 0.85$ and $p = 0.341$, respectively), increased frequency of eating and drinking between meals or with the reduced quality of toothbrushing during hospitalization ($p =$ NS).

However, the degree of reduced frequency of toothbrushing in the morning-during hospitalization was statistically significantly related to the lack of offered assistance in brushing teeth by the nursing staff ($p = 0.004$). Out of 13 (26%) patients who reported reducing their frequency of toothbrushing during hospitalization in the morning, 6 (46%) claimed that the reason for this was a lack of assistance in toothbrushing, 1 (7.7%) due to a lack of a toothbrush, three patients (23%) due to pain during brushing and three patients (23%) argued that brushing during this period is not important enough.

3.7 | The attitude of the nursing staff towards the maintenance of the dental health of their patients

According to patients' reports depicted in Table 3, surprisingly, 83.3% of the nurses never instructed their patients to brush their teeth daily. Moreover, 95.9% and 93.9% of the nursing staff never instructed their patients to limit their consumption of sweets and sugary drinks between meals. The nurses paid significantly less attention to their patients' consuming sugary drinks between meals as compared to their toothbrushing ($p = 0.010$, CC = 0.3690).

Importantly, decreased frequency of toothbrushing during hospitalization was positively correlated only with lack of assistance and a need for assistance from the nursing staff ($p = 0.004$), but not correlated statistically with the nursing staff offering toothbrushes/toothpaste ($p =$ NS), or with reminding the patients to reduce consumption of sugary drinks ($p =$ NS) and sweets between meals ($p = 0.47$). Patients in the rehabilitation and geriatrics departments reported a statistically significantly greater need for a toothbrush/paste ($p < 0.0001$) and for assistance ($p < 0.0001$) in performing toothbrushing.

3.8 | Receiving dental care during hospitalization

Most hospitalized patients reported that they had undergone many dental treatments (68%), despite, 46% having their last appointment 2 years or more before hospitalization. Of the patients, 2.1% and 6.4% had to cancel an appointment for a checkup or treatment, respectively, and 8.3% of the patients needed emergency dental treatment during hospitalization.

4 | DISCUSSION

The objective of this study was to examine factors associated with changes in two key variables that can lead to permanent deterioration in dental health during prolonged hospitalization: decreased frequency of patient toothbrushing and increased consumption of fermentable carbohydrates between meals.

In our study, approximately 25% of patients reported a decrease in toothbrushing frequency during their hospital stay. This finding was consistent across different age groups, genders and durations of hospitalization. It was not influenced by the frequency of toothbrushing at home, the timing of the last dental check-up, or the number of past dental treatments received.

A previous study by Kim et al.[21] also reported a decrease of 12.3% in toothbrushing frequency and of 24.1% in duration during hospitalization, although our study showed a higher percentage of patients with decreased frequency (26% and 20% decreased frequency in the morning and in the evening, respectively) and a lower percentage with decreased duration (17.8%). This difference could be attributed to variations in study design, in our study, questionnaires were answered by patients in real-time during hospitalization, while Kim's[21] study relied on retrospective questionnaires that might be prone to recall bias over time.

The main factor associated with the reduction in toothbrushing frequency in our study was the absence of assistance from the nursing staff. Additionally, 26.5% of patients admitted to not having a toothbrush and expressed a willingness to receive one. This highlights the lack of awareness among nursing staff regarding their patients' oral hygiene maintenance, which has been well documented in previous publications.[16,22,23,25,26] As shown in these studies, despite recognizing the importance of comprehensive oral care for patients' overall health, nurses often fail to incorporate oral hygiene tasks into their routine care discussions. Reasons cited by nursing staff, include lack of: time (81.8%), patient cooperation (54.4%), knowledge and experience (7.2%).[16]

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TABLE 3 Distribution of answers regarding the role of the nursing staff in the maintenance of oral health.

		Orthopaedic		Geriatrics		Neurology		Rehabilitation		Total		
Questions	**Variables**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	**Number**	**%**	***p*-value**
Did the nursing staff remind you to brush your teeth?	Not at all during hospitalization	6	85.7	24	100.0	1	25.0	8	66.7	40	83.3	<0.0001
	Yes, once or twice during my hospitalization	1	14.3	0	0.0	0	0.0	2	16.7	3	6.3	
	Yes, once a week	0	0.0	0	0.0	0	0.0	1	8.3	1	2.1	
	Yes, daily	0	0.0	0	0.0	3	75.0	1	8.3	4	8.3	
Did the nursing staff remind you not to eat snacks / sweets frequently between meals?	Not at all during hospitalization	8	100.0	23	95.8	4	100.0	11	91.7	47	95.9	0.671
	Yes, once or twice during my hospitalization	0	0.0	1	4.2	0	0.0	0	0.0	1	2.0	
	Yes, daily	0	0.0	0	0.0	0	0.0	0	0.0	0	0	
Did the nursing staff remind you not to drink sugary drinks between meals?	Not at all during hospitalization	0	0.0	0	0.0	0	0.0	1	8.3	1	2.0	0.08
	Yes, once or twice during my hospitalization	7	87.5	24	100.0	3	75.0	11	91.7	45	93.9	
	Yes, daily	1	12.5	0	0.0	0	0.0	0	0.0	1	2.0	
Did the nursing staff offer you a toothbrush during hospitalization?	Not at all during hospitalization, although I would be happy to get one	0	0.0	0	0.0	0	0.0	0	0.0	0	0	0.111
	No, I don't need one	0	0.0	0	0.0	1	25.0	1	8.3	2	4.2	
	I was offered and accepted	0	0.0	8	33.3	1	25.0	4	33.3	13	31.3	
Did the nursing staff offer assistance in toothbrushing during hospitalization	Not at all during hospitalization, although I would be happy to get assistance	7	87.5	16	66.7	2	50.0	8	66.7	30	62.5	<0.001
	No. I don't need assistance	1	12.5	0	0.0	1	25.0	0	0.0	2	4.2	
	Only on my admission to the hospital	0	0.0	9	37.5	0	0.0	5	41.7	14	31.3	
Did the nursing staff remind you to take a shower and offer assistance or soap?	Yes, they remind me daily and offer assistance, soap and shampoo	7	100.0	15	62.5	2	50.0	6	50.0	30	62.5	0.278
	Yes, they reminded me daily and offered assistance but did not offer soap or shampoo	0	0.0	0	0.0	0	0.0	0	0.0	0	0	
	Yes, they reminded me daily but did not offer assistance or soap/shampoo	0	0.0	0	0.0	0	0.0	1	8.3	1	2.1	
	Yes, occasionally	0	0.0	0	0.0	2	50.0	0	0.0	2	4.2	

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To increase nursing staff involvement in oral health maintenance, Gibney et al.[24] suggested integrating professional routine dental support within their regular practice.

Routine provision of toothbrushes and toothpaste, similar to other hygiene supplies, such as soap, towels and cloths, could also contribute to increased toothbrushing frequency among hospitalized patients. The lack of regular supplies may negatively impact staff awareness on the importance of toothbrushing. In contrast, nurses demonstrated a higher level of attention to body hygiene, with reminders and assistance provided for daily showers to a significant percentage of patients.

The second key factor affecting dental health deterioration during prolonged hospitalization is the increased consumption of fermentable carbohydrates and sugary drinks between meals.[28,29] In our survey, 23.1% and 38% of patients, respectively reported an increased consumption of sweets/snacks and sugary/carbonated drinks, during hospitalization. This alteration in carbohydrate consumption was general and was not correlated to the age of the patient or the type of inpatient department. Surprisingly, a large majority of patients 95.9% and 93.9%, respectively reported nurses never advised them to limit their consumption of sweets/snacks and sugary drinks between meals. This neglect is concerning, as it significantly raises the risk of developing caries over an extended duration.[17,28,29] Notably, nurses' disregard for the frequency of consuming fermentable carbohydrates was even greater than their disregard for oral hygiene maintenance. Further studies should evaluate nursing staff knowledge regarding the detrimental effects of frequent consumption of fermentable carbohydrates.

Another noteworthy finding was that 8.3% of hospitalized patients reported requiring emergency dental treatment during their hospital stay. Hospitals should be prepared to provide dental services in these emergencies, just as they do for other medical conditions. This is particularly important for patients who are unable to leave the hospital.[30]

This study reiterates the need for enhanced attention to the oral health of patients, among the nursing staff. This attention is particularly crucial for elderly patients with comorbidities, who take multiple medications and may experience a decline in immune system function. Additionally, dentists should take additional diagnostic and preventive measures following patients' discharge from the hospital. Detailed interviews regarding changes in food and sugary drink consumption and toothbrushing habits are recommended, along with increased diagnostic measures, such as more frequent bitewing X-rays and emphasis on preventive dental care to mitigate the deterioration of oral health.

Limitations of this study include the small cohort and that the information collected relied only on patients' self-report not on clinical exams to evaluate the changes in oral health measures. Notwithstanding, this was also a strength of the study, as these self-report questionnaires were answered by patients in real-time during hospitalization, as opposed to previous retrospective survey studies, which were prone to recall bias.

5 | CONCLUSIONS

Prolonged hospitalization often leads to significant deterioration in dental health maintenance among patients, with nursing staff failing to address these issues. As a result, patients are at an increased risk of developing oral, dental and systemic diseases. Raising awareness among nurses regarding their inpatient's oral health maintenance is warranted. Additionally, dentists should conduct detailed interviews regarding changes in oral health habits during prolonged hospital stays and take appropriate diagnostic and preventive measures to address the deterioration of patients' oral health.

6 | CLINICAL RELEVANCE

6.1 | Scientific rationale for the study

To evaluate the effect of prolonged hospitalization on the maintenance of patient's dental health and to assess the nursing staff's approach to addressing these issues.

6.2 | Principal findings

Prolonged hospitalization led to a significant deterioration in dental health maintenance among 25%–40% of the patients correlating to the large majority who lacked assistance in toothbrushing or reminders to limit consumption of carbohydrates between meals.

6.3 | Practical implications

Increasing nursing staff awareness on the importance of regular toothbrushing and limiting consumption of fermentable carbohydrates through periodic seminars and providing patients with toothbrushes, toothpaste and educational materials upon hospitalization is recommended.

AUTHOR CONTRIBUTIONS

SW and NT reviewed the questionnaire, collected the data, and reviewed the manuscript; LO helped with the application for the Institutional Review Board for approval, reviewed the questionnaire and the manuscript; SS reviewed the questionnaire and the manuscript, GC performed all the statistical analysis and reviewed the manuscript, NY helped with the application for the Institutional Review Board for approval, and reviewed the manuscript; MA conceived the ideas, helped with the application for the Institutional Review Board for approval, analysed the data and led the writing.

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The authors have nothing to report.

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None to declare.

CONFLICT OF INTEREST STATEMENT

None of the authors has any conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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