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Original Article

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Factors influencing oral health in patients with acute stroke receiving enteral nutrition

Abstract

Aim: International stroke guidelines highlight the importance of oral health and hygiene in stroke care—not only for enhancing patient comfort but also as a crucial intervention to reduce infection risks and complications. Despite this, limited research has examined the factors influencing oral health in post-stroke patients who are unable to eat orally and depend on nasogastric tube (NGT) feeding.
Materials and Methods: This study employed a cross-sectional and descriptive design. The study population comprised 72 patients who were admitted to the neurology intensive care unit of a university hospital in İzmir with an acute stroke diagnosis between June 2020 and August 2021. Data collection tools included the Glasgow Coma Scale (GCS), the National Institutes of Health Stroke Scale (NIHSS), the Bedside Oral Assessment Scale (BOAS), and the Patient Information Form. Statistical analyses were performed using Pearson Correlation, Independent-Samples T-test, ANOVA, and Post Hoc-Tukey analysis.
Results: The mean oral health score on the first day of hospitalization was 13.03±1.31, increasing to 16.25±3.40 by the seventh day. Statistical analysis confirmed that this difference was statistically significant ($p<0.05$). Additionally, higher oral health scores were significantly associated with increasing age, smoking habits, presence of chronic illness, history of stroke, presence of dysphagia, impaired consciousness, and greater stroke severity.
Conclusion: This study found that stroke patients receiving nasogastric tube feeding exhibited poor oral health. Additionally, factors such as advanced age, gender, dysphagia, stroke type, stroke severity, and level of consciousness significantly influenced oral health status. These findings emphasize the need for comprehensive oral care protocols in stroke patients, particularly those on enteral nutrition, to reduce complications and improve overall health outcomes.

Keywords: Acute stroke, oral health, nasogastric tube feeding, stroke rehabilitation

INTRODUCTION

Each year, 13.7 million people worldwide experience a stroke, with 5.5 million deaths attributed to stroke-related complications. Globally, stroke is the second leading cause of death (1). In Türkiye, stroke remains the second leading cause of mortality, following cardiovascular diseases, and is the primary cause of permanent disability (2).

Stroke can lead to dysfunction in the oropharyngeal region, gastric region, and lower esophageal sphincter (3). Clinical guidelines recommend initiating enteral nutrition within the first 72 hours post-stroke, with continuation beyond seven days in cases of severe dysphagia (4). Studies estimate that 10%–44% of post-stroke patients require nasogastric tube (NGT) feeding (5,6).

Although NGT feeding reduces the risk of aspiration from oral intake, it is associated with a significantly higher incidence of pneumonia (7). This increased risk is attributed to the pathological colonization of bacteria in the oropharynx, which occurs with prolonged NGT use. Additionally, NGT feeding

reduces stimulated salivary flow, further predisposing patients to bacterial colonization in the oropharynx (8).

Post-stroke cognitive impairments—such as deficits in attention, memory, orientation, perception, along with reduced alertness, hemiplegia, poor balance, lack of coordination, decreased muscle strength, facial paralysis, weakened lip strength, tongue weakness, and chewing-swallowing disorders—significantly hinder patients' ability to maintain oral hygiene (9). Additionally, oral health and hygiene are often overlooked in NGT-fed stroke patients (10), leading to complications such as reduced salivary flow, dry mouth, and dental caries (11).

Poor oral hygiene results in significant plaque accumulation, which not only contributes to plaque-related oral diseases but also serves as a reservoir for opportunistic oral pathogens linked to pneumonia (12). Research consistently indicates that post-stroke patients exhibit poor oral health (13). A meta-analysis comparing oral health pre- and post-stroke found increased tooth decay and higher plaque indices in post-stroke patients (9). Furthermore, recent stroke survivors harbor higher counts of aerobic and anaerobic gram-negative bacilli in their oral cavities, significantly increasing the risk of systemic infections compared to healthy individuals (14).

International stroke guidelines emphasize the critical role of oral health and hygiene in stroke care, not only for enhancing patient comfort but also as a key intervention to reduce infection risks and complications (15). However, limited research has explored the factors affecting oral health in post-stroke patients who do not receive oral feeding and instead rely on NGT feeding. Therefore, this study aims to assess the impact of sociodemographic characteristics and clinical outcomes—including consciousness level, stroke severity, and dysphagia—on oral health status in this patient population.

Research Questions

1. What are the sociodemographic characteristics, medical profiles, and oral health status of NGT-fed post-stroke patients?
2. Does oral health status vary according to the sociodemographic characteristics of NGT-fed post-stroke patients?
3. Does the presence of dysphagia influence the oral health status of NGT-fed post-stroke patients?
4. Does oral health status differ based on Glasgow Coma Scale (GCS) scores in NGT-fed post-stroke patients?
5. Does oral health status vary according to National Institutes of Health Stroke Scale (NIHSS) scores in NGT-fed post-stroke patients?

MATERIALS AND METHODS

This study was designed as a cross-sectional and descriptive study and was conducted in the neurology intensive care unit of a university hospital in Izmir between June 2020 and August 2021. The study population consisted of 121 patients diagnosed with acute stroke during the study period. Among these, 72 patients met the inclusion criteria, which required no oral intake for the first seven days post-stroke. These patients formed the study sample. The sample size was determined as 70 patients, with an 80% confidence level and a 5% margin of error.

Inclusion criteria for the study were: patients aged ≥18 years, diagnosed with acute stroke, having no oral intake, and receiving enteral feeding via a NGT. Patients were excluded if they had a history of head or neck surgery, pre-existing dysphagia before stroke, mechanical ventilation, or if oral intake was initiated within the first seven days post-stroke. A post hoc power analysis was conducted to calculate the statistical power of the sample.

The independent variables in the study included age, gender, presence of chronic diseases, stroke frequency, dysphagia, level of consciousness, stroke severity, and smoking status. The dependent variable was oral health status.

Data Collection Tools

Data for this study were collected using the following instruments: the Patient Information Form, NIHSS, GCS, and Bedside Oral Assessment Scale (BOAS).

The Patient Information Form was developed based on existing literature and similar studies (13,16). It consists of five questions addressing demographic characteristics, presence of chronic illnesses, and smoking status.

National Institutes of Health Stroke Scale

The National Institutes of Health Stroke Scale is one of the most widely used tools for assessing stroke severity in neurology units. It evaluates various neurological functions, including level of consciousness, response to verbal commands, extraocular movements, visual field, facial paralysis, motor function in the arms and legs, ataxia, sensory loss, aphasia, dysarthria, and neglect. The scale consists of 11 items, each with three sub-items, yielding a maximum score of 36 points. A lower NIHSS score indicates better post-stroke clinical status.

Stroke severity is classified based on NIHSS scores as mild (NIHSS <8), moderate (NIHSS 8–16), and severe (NIHSS >17). The scale was validated by Brott et al. in 1989 (0.69) and is internationally recognized as a standard assessment tool for stroke severity (17). In this study, stroke severity was evaluated by a physician using the NIHSS. The validity and reliability coefficient of the NIHSS was found to be p=0,69 and p=84 in our study.

Glasgow Coma Scale

Glasgow Coma Scale is the gold standard for assessing consciousness, determining prognosis, and guiding clinical

decisions in patients with acute neurological disorders or brain injuries. It is widely used in both clinical practice and research as a standardized tool that provides a common language among healthcare professionals. The GCS evaluates three main parameters: eye response (maximum score: 4), verbal response (maximum score: 5), and motor response (maximum score: 6). If no response is observed, each parameter is assigned a score of 1, and the total score is calculated by summing the points from all three categories. The maximum possible score is 15, indicating normal consciousness. Based on the GCS scoring interpretation, a score of 13–15 indicates mild brain injury, 9–12 represents moderate brain injury, and ≤8 signifies severe brain injury, with a score of 3 indicating deep coma, the lowest possible score. If any component of the GCS cannot be assessed, the total score cannot be calculated. The validity and reliability coefficient of the GCS was found to be p=0.89 and p=84 in our study.

Bedside Oral Examination Scale

The Bedside Oral Examination Scale, originally developed by Eilers (1988) and later revised by Prendergast et al. (2013) for use in neurology intensive care unit (ICU) patients, is a tool designed to assess oral health status. It is suitable for use by healthcare professionals without specialized dental training (Everaars et al., 2020). The scale evaluates eight sub-categories, including swallowing, lips, tongue, saliva, mucous membranes, gums, teeth or dentures, and smell. Each sub-category is scored from 1 to 3, where 1 indicates normal/healthy function, 2 represents mild dysfunction, and 3 reflects severe dysfunction. The total score ranges from 8 to 24, with lower scores indicating better oral health and higher scores reflecting poorer oral health. A score of 8 corresponds to excellent oral health, while 24 indicates poor oral health. Due to COVID-19 isolation protocols, the smell sub-category was not evaluated in this study, and all patients were assigned 1 point for this category. The scale's validity was confirmed by Çelik and Eşer (2017), with a validity coefficient of 0.92, indicating excellent reliability (18,19). The validity and reliability coefficient of the BOE was found to be p=0.76 and p=81 in our study.

Data Collection

Data were collected using the Patient Information Form and Bedside Oral Examination Scale through face-to-face interviews and observations of patients and their relatives within the first 24 hours post-stroke.

Clinical physicians assessed GCS and NIHSS scores within the first 24 hours through clinical examination. These measurements were only recorded upon initial admission, with no follow-up reassessments. The researcher accessed these data from patient medical records within the first 24 hours.

The presence of dysphagia was determined by physicians based on clinical examination and swallowing assessments, without using a standardized dysphagia scale or grading system. The researcher obtained this information by consulting physicians and nurses.

All patients included in the study had no oral intake for the first seven days post-stroke and began NGT feeding within 72 hours. Clinical nurses provided oral care twice daily using 0.12% chlorhexidine solution with the wiping method.

Oral health was evaluated by the researcher at the same time each day, prior to oral care, for seven consecutive days using the Bedside Oral Examination Scale. The study focused on the first week post-stroke, as this period is associated with higher risks of consciousness disturbances, immunosuppression, and dysphagia, all of which can significantly impact oral health (20).

Data Analysis

Statistical analyses were conducted using IBM SPSS Statistics for Windows, version 22.0 (SPSS Inc., Chicago, IL, USA). Categorical variables were presented as frequency (n) and percentage (%). Numerical variables were presented as mean (M) and standard deviation (SD).

The linear relationship between two independent numerical variables was assessed using Pearson's correlation (bivariate analysis). The independent samples t-test was used to compare means between two independent groups. The one-way analysis of variance (ANOVA) was applied to compare means across more than two independent groups. Post hoc Tukey analysis was performed to determine which groups exhibited significant differences. Statistical significance was set at $p<0.05$, with all results evaluated at a 95% confidence interval (CI).

Ethical Aspects of the Study

Ethical approval was obtained from the Medical Research Ethics Committee of a University Hospital (Date: 24.06.2020, Decision No: 20-6.1T/45) and the Department of Neurology.

Informed consent was obtained both verbally and in writing from patients with full consciousness. For patients with impaired consciousness, consent was obtained from their first-degree relatives.

Before participation, the purpose of the study was explained to all participants, who were given the opportunity to ask questions. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

RESULTS

The mean age of the patients included in the study was 63.54±12.6 years. Among them, 54.2% were female, 91.7% had ischemic stroke, 87.5% had at least one chronic illness, and 30.6% were smokers (Table 1).

Table 1. Sociodemographic and medical characteristics of patients	
Variable	**n (%) / Mean±SD**
Age (years)	63.54±12.64
Gender	
Female	39 (54.2%)
Male	33 (45.8%)
Stroke type	
Ischemic	66 (91.7%)
Hemorrhagic	6 (8.3%)
Chronic disease	
Yes	63 (87.5%)
No	9 (12.5%)
Hypertension	
Yes	39 (54.2%)
No	33 (45.8%)
Smoking	
Yes	22 (30.6%)
No	50 (69.4%)

The mean Bedside Oral Assessment Scale (BOAS) score on the first day showed no significant differences when analyzed according to age, gender, stroke type, NIHSS, and GCS variables.

On the seventh day, BOAS scores were analyzed based on various patient characteristics. It was found that patients aged 50–69 and those over 70 had significantly higher BOAS scores compared to patients aged 30–49 ($p<0.05$). Additionally, female patients, those with at least one chronic illness, smokers, patients with hemorrhagic stroke, and those with a history of stroke and dysphagia exhibited significantly higher BOAS scores ($p<0.05$).

The mean BOAS scores on the first and seventh days post-stroke were 13.03±1.31 and 16.25±3.40, respectively. The difference between these two means was found to be statistically significant ($p<0.05$) (Table 2).

Table 2. Comparison of BOAS scores by demographic and medical variables		
Age groups	**Mean±SD**	**P**
[a]30-49	9.666±0.500	a≠b 0.000
[b]50-69	16.923±2.527	a≠c 0.000
[c]70 and older	17.625±2.280	**(0.00)****
Gender		
Female	17.15±3.297	**0.013**
Male	15.18±3.235	(0.005)*
Chronic disease		
Yes	16.85±3.004	**0.001**
No	12.00±3.000	(0.152)*
Stroke type		
Ischemic	16.00±3.423	**0.000**
Hemorrhagic	19.00±1.095	(3.399)*
Stroke history		
Yes	19.00±1.154	**0.005**
No	16.08±3.41	(2.427)*
Dysphagia		
Yes	18.15±2.33	**0.000**
No	13.25±2.52	(0.350)*
Smoking		
[a]Every day	19.03±1.80	a≠b 0.000*
[b]Sometimes	15.72±1.31	a≠c 0.000* b≠c 0.000*
[c]Never	12.63±2.08	**0.000**
Oral health score		
BOAS_1	13.03±1.31	**0.000*****
BOAS_7	16.25±3.40	**(0.705)**

BOAS_1: first-day evaluation of the Bedside Oral Assessment Scale, BOAS_7: seventh-day evaluation of the Bedside Oral Assessment Scale, *p: independent-sample T-test, **p: ANOVA-Post Hoc-Tukey analysis, ***p: paired samples test, SD: standard deviation

A positive linear correlation was identified between BOAS scores and both age and NIHSS scores, whereas a negative linear correlation was observed between BOAS scores and GCS averages ($p<0.05$) (Table 3). The patients' daily oral health scores ranged from a minimum of 12.27±1.43 to a maximum of 16.25±3.40 (Table 4).

Table 3. Correlation between BOAS_7 scores and clinical variables

Variable	Mean±SD	Correlation (rP)	p-value
Age (years)	63.54±12.64	0.554	0.000**
GCS score	11.25±2.18	-0.306	0.009*
NIHSS score	10.20±3.35	0.267	0.024*

BOAS_7: seventh-day evaluation of the Bedside Oral Assessment Scale, SD: standard deviation, GCS: Glasgow Coma Scale, NIHSS: National Institutes of Health Stroke Scale, rP: Pearson correlation coefficient

Table 4. Daily BOAS score averages

Day	Mean±SD (N=72)
1st day	12.27±1.43
2nd day	13.08±1.44
3rd day	14.42±1.56
4th day	15.08±1.68
5th day	15.58±1.90
6th day	15.50±2.40
7th day	16.25±3.40

DISCUSSION

Following a stroke, consciousness disturbances and motor function impairments significantly limit oral intake, necessitating the use of enteral nutrition to prevent malnutrition and ensure patient safety. Studies indicate that 10–44% of stroke patients require NGT feeding (5,6). However, the factors influencing oral health in this patient group remain insufficiently defined. Therefore, this study aimed to identify the variables affecting oral health in stroke patients who rely on enteral feeding due to oral intake limitations.

The mean age of the patients was 63.54 years, with 54.2% being female. The majority (91.7%) had ischemic stroke, and 87.5% had at least one chronic illness, with hypertension being the most common. The smoking rate among patients was consistent with findings from similar studies (21,22).

When evaluating oral health status on the first and seventh days post-stroke, the mean BOAS scores were 13.03±1.31 and 16.25±3.40, respectively. This significant increase in BOAS scores indicates a notable deterioration in oral health within the first week.

Previous studies have demonstrated that oral health begins to decline after 72 hours in stroke patients, with prolonged NGT feeding further exacerbating this deterioration (13). Additionally, research indicates that NGT-fed stroke patients exhibit poorer oral health compared to those receiving oral intake (23).

The findings of this study indicate that advanced age is associated with a decline in oral health, with older patients exhibiting the poorest oral health outcomes. Recent research also underscores the impact of aging, swallowing difficulties, malnutrition, and progressive functional decline on oral health status (7). Additionally, stroke patients with immune suppression, limb weakness, and comorbidities are at an increased risk of oral health deterioration (14). Given these factors, maintaining optimal oral health is particularly critical for elderly stroke patients receiving enteral nutrition.

Contrary to some previous studies, our results showed that female patients had poorer oral health than male patients. This finding may be attributed to the higher proportion of female participants in our sample and the relatively small sample size, which could have influenced the results.

Stroke type, chronic illness, and a history of stroke were also found to be significant factors influencing oral health. Patients with a history of stroke and those with chronic diseases such as hypertension exhibited greater susceptibility to oral health issues, which aligns with findings from previous studies (22,24).

Limitations

This study has several limitations. The sample size was limited to 72 patients from a single center, which may restrict the generalizability of the findings. Additionally, dysphagia was not assessed using a standardized tool, and the severity of dysphagia was not systematically measured. Due to COVID-19 isolation protocols, the smell dimension of the BOAS could not be evaluated. Furthermore, oral care practices were not standardized, which may have influenced the results.

CONCLUSION

The findings of this study indicate that stroke patients receiving NGT feeding experience poor oral health. Several factors were identified as contributing to worsening oral health, including advanced age, smoking, chronic diseases, and a history of previous strokes. Additionally, the presence of dysphagia, decreased consciousness levels, and increased stroke severity were found to have a negative impact on oral health status.

Given these findings, it is essential for nurses and healthcare professionals to recognize the risk factors affecting oral health in post-stroke patients. Healthcare providers should incorporate oral health assessments into routine stroke care, tailor oral

hygiene interventions based on individual risk factors, and provide education to patients and their caregivers to promote better oral health outcomes for NGT-fed stroke patients.

This study underscores the importance of oral health in non-mechanically ventilated stroke patients who require NGT feeding due to dysphagia or impaired consciousness. By identifying and addressing key risk factors, targeted interventions can be implemented to improve oral health outcomes in this vulnerable patient group. The findings of this study have valuable implications for both clinical practice and home care settings, offering guidance for healthcare professionals and caregivers in optimizing oral hygiene management for stroke patients.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
Ethical approval was obtained from the Medical Research Ethics Committee of Ege University (Date: 24.06.2020, Decision No: 20-6.1T/45) and the Department of Neurology.

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