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Empowered or disadvantaged? Investigating the impact of dentures restrictions on patients with stroke in the intensive care unit

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ABSTRACT

Aim: The rate of denture use increases with aging. Stroke dramatically increases the risk of swallowing impairment, especially in the elderly population. The aim of this study was to investigate the swallowing safety of individuals in the intensive care unit who were not using their own dentures.

Methods: This cross-sectional study was conducted on patients with ischemic stroke who scored 24 and above on the Mini Mental State Examination test admitted to Bolu Abant Izzet Baysal University Training and Research Hospital and monitored in intensive care unit. The severity of stroke, as measured by the National Institutes of Health Stroke Scale, and the clinical classification of stroke using the Bamford Classification were documented. The Acute Stroke Dysphagia Screening, including the 3-ounce water swallowing test, was used to examine the swallowing safety of the individuals.

Results: A total of 16 individuals were included in the study. Individuals were divided into 2 groups: those with natural teeth and those who have dentures but are restricted in their use. The groups were similar with respect to stroke severity, stroke classification, age and gender. Considering swallowing safety, individuals who had dentures but were restricted from using them under intensive care conditions exhibited a higher level of success (p=0.041).

Conclusions: As a result of this study, it has been shown that individuals who were restricted from wearing prosthesis in intensive care conditions and who continue oral nutrition with foods that do not require chewing are not at risk as much as thought. Restricting the use of denture, including those with palatal coverage, may provide an advantage in terms of swallowing safety due to an increased sensory field.

Key words: Stroke, intensive care unit, swallowing, dysphagia, dentures.

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Introduction

Stroke is reported as the most prevalent life-threatening and disability-inducing neurological disease among the elderly [1]. Aging is the strongest non-modifiable risk factor for stroke, with the risk doubling every 10 years after the age of 55. Life expectancy is gradually increasing worldwide and the proportion of older adults compared to other age groups continues to grow, leading to the aging of society, especially in developed countries [2-4]. With the increasing elderly population, stroke-related health problems and

their impact on quality of life continue to be an important problem for countries and societies. Nutrition is a prerequisite for maintaining the structure and function of the organism. Nutrition in the elderly can be affected for various reasons and is associated with fragility and sarcopenia. Physiologic changes that occur with aging affect the nutritional status of the elderly [5]. Having suffered a stroke can further contribute to various nutritional problems [6].

Chewing and insalivation are important processes in the digestion of food; the various dental problems faced by the elderly population can lead to difficulties in these basic processes, resulting in changes in the variety of foods to be consumed, which can lead to malnutrition and sarcopenia [7]. Furthermore, poor oral hygiene and poor oral health can predispose to chronic inflammation of the lower respiratory tract through diseases such as periodontitis, which can predispose to the onset of sarcopenia [8]. Sarcopenia is a condition that impacts all muscles throughout the body, including those crucial for chewing and swallowing. This has a detrimental effect on food intake and can turn this process into a 'vicious circle' [9,10]. Furthermore, it has recently been shown that sarcopenia can be considered an independent risk factor for dysphagia by reducing the strength of the swallowing muscles [11-13].

With aging comes a greater risk of exposure to chronic oral diseases such as dental caries and periodontal disease [14,15]. Consequently, these conditions may lead to a higher incidence of tooth loss and a greater need for dental prostheses [16,17]. The heightened severity of tooth loss is deemed the most significant oral health issue among the elderly, affecting various aspects of their lives [18]. Studies have shown that the elderly may face high rates of tooth loss [19,20].

Medical complications such as pneumonia that can occur after stroke can increase mortality and length of hospitalization in acute and subacute stroke [21,22]. Pneumonia stands out as a prevalent and significant complication of stroke, impacting approximately one-third of patients [23,24]. Pneumonia has a major impact on the prognosis of patients with stroke and may increase mortality [24]. Risk factors associated with pneumonia after stroke include aging, inadequate oral hygiene, decreased level of consciousness and impaired swallowing function [25]. Stroke patients with dysphagia have a significantly increased risk of stroke-related pneumonia [26,27]. Acute patients with stroke who require intensive care have higher rates of stroke-related pneumonia [28,29].

Another risk factor for pneumonia is dental prostheses. In edentulous people, dentures can easily act as bacterial reservoirs if not properly cleaned. Removing dentures during sleep or in patients in intensive care is a preventive strategy to reduce comorbidities in patients with unstable health conditions [30] When predictive factors for swallowing disorders and 'stroke-related pneumonia are analyzed, denture use is associated with an increased risk of swallowing disorders in the subacute period. It was suggested that this relationship should be investigated in the acute period [31]. It was also reported that the use of removable dentures may cause taste and odor problems [32]. This information suggests that dental prostheses may have an effect on oral sensation and swallowing safety. Determining the appropriate feeding method and equipment for feeding a small group of conscious individuals eligible for oral feeding in the intensive care unit is crucial. The aim of this study was to evaluate and compare the risk of dysphagia in individuals with acute stroke who possessed dentures but did not use

them in the intensive care setting, in comparison to individuals without dentures.

Materials and methods

Study Design

This is a cross-sectional study. The study was carried out on 16 patients who met the inclusion criteria. This study was conducted in accordance with the Declaration of Helsinki with the permission of the local ethics committee (2023/282-376). The inclusion criteria for this study, which was conducted in individuals diagnosed with ischemic stroke by a neurologist and followed up in intensive care unit, were as follows: voluntary participation in the study, a score of at least 24 or more on the Mini-Mental State Examination Test and a score of 15 or less on the The National Institutes of Health Stroke Scale (NIHSS) scale (mild and moderate stroke). Exclusion criteria were: having other neurological diseases other than stroke, having had a previous stroke, unable to take the required test measurement positions and inability to comprehend and execute the questions and/or instructions provided, not using dental prostheses for more than 3 months due to incompatibility and the existence of a tracheostomy.

Assessments

Socio-demographic characteristics, use of denture, clinical stroke classification (Bamford Classification) and NIHSS scores indicating stroke severity were recorded.

In this study, which was conducted in the acute phase of stroke, the Acute Stroke Dysphagia Screening was used to evaluate individuals in terms of swallowing safety.

Determination of Clinical Stroke Type and Severity

The National Institutes of Health Stroke Scale was used to determine acute stroke severity. Stroke survivors were assessed on 11 sub-items including state of consciousness, motor function and ataxia. The categories based on the score are as follows: mild stroke = 1-4, moderate = 5-15, moderate to severe = 16-20, severe = 21-42 [33]. Individuals with an NIHSS score of 15 and below were included in this study.

The Bamford Classification was used to classify patients with ischemic stroke into four groups according to clinical findings. The groups according to signs and symptoms consisted of Lacunar Infarcts (LACI), Total Anterior Circulation Infarcts (TACI), Partial Anterior Circulation Infarcts (PACI) and Posterior Circulation Infarcts (POCI) [34].

Acute Stroke Dysphagia Screen

This is a screening test that examines the Glasgow Coma Scale score, facial asymmetry, tongue asymmetry and palatal asymmetry. After the evaluation of the first four steps, eligible patients underwent a 3-ounce water swallowing test to determine the risk of aspiration. The test consists of 5 items in total. Each item was answered as 'Yes' and 'No' during the measurements. Patients who responded 'No' to the initial four questions successfully proceeded to the fifth item, the 3-ounce water swallowing test, to determine the risk of aspiration. The test was considered failed if signs of aspiration were observed [35]. In this method, which is widely used in the evaluation of individuals with oropharyngeal dysphagia and aspiration risk, individuals were asked to drink 3 ounces (90 cc) of water without interruption. Individuals were classified as having failed the test if they were incapable of completing the task or displayed symptoms such as coughing, choking, or a wet voice within 1 minute [35]. The sensitivity value of the screening to determine the presence of dysphagia has been reported as 91% and the specificity value as 74% [35].

Statistical Analyses

Data were analyzed using the IBM SPSS 24.0 package program. The compatibility of the variables with normal distribution was analyzed by skewness and kurtosis values (1 to +1 range is considered normal). Descriptive analyses were expressed as mean and standard deviation for numerical variables, frequency tables (n) and ratios (%) for ordinal variables. In the study, individuals were divided into 2 groups according to their denture ownership. 'Independent sample t test' was used to determine the variation of continuous variables according to the groups. Differences between categorical variables were analyzed by Chi-square and Fisher's Exact analysis. In all analyzes, $p<0.05$ was considered statistically significant.

Results

The study included 16 individuals with a mean age of 72 ± 7.77 years. The individuals were divided into two groups according to their denture ownership status. The denture group consisted entirely of females, while the non-denture group included 1 male individual (12.5%) and 7 female individuals (87.5%). The average NIHSS score was 3.75 ± 3.454 in the denture group and 1.25 ± 1.389 in the non-denture group. There were no significant differences between the groups in terms of age and NIHSS scores ($p>0.05$) (Table 1). The groups were considered similar in terms of age and disease severity.

When the groups were compared, no statistically significant difference was observed in terms of gender and clinical stroke

Table 1. Age and stroke severity status of individuals.

Parameters	**Dental prosthesis (n = 8)**			**Non-dental prosthesis (n = 8)**			***p***
	X±SS	**Min**	**Max**	**X±SS**	**Min**	**Max**	
Age (year)	75,38 ± 8,601	50	89	68,63 ± 5,423	58	75	*0,081*
NIHSS	3,75 ± 3,454	0	8	1,25 ± 1,389	0	3	*0,089*

Independent Sample t-Test, ,* p<0.05; X±SS: Mean±standard deviation;NIHSS: National Institutes of Health Stroke Scale

Table 2. Demographic and clinical data.

Parameters	**Dental prosthesis (n = 8)**		**Non-dental prosthesis (n = 8)**		***p***
	n	**%**	**n**	**%**	
Gender [a]					
Female	8	100	7	87,5	
Male	0	0	1	12,5	*0,999*
Bamford Classification					
TACI	1	12,5	2	25	
PACI	1	12,5	2	25	*0,767*
POCI	4	50	3	37,5	
LACI	2	25	1	12,5	

Chi-Square test, [a]: Fisher Exact test, %: Percentage; TACI: Total anterior circulation infarcts; PACI: Partial anterior circulation infarcts; POCI: Posterior circulation infarcts; LACI: Lacunar infarcts

classification (Bamford) (p>0.05) (Table 2). The groups were also considered similar in terms of these factors.

We conducted a Fisher Exact test to evaluate swallowing safety according to the status of denture ownership. In the denture group, no individual failed the first step of the Acute Stroke Dysphagia Screen, while one individual failed the first step in the non-denture group. In the denture group, observed frequencies indicated that 7 individuals passed the Acute Stroke Dysphagia Screen test, while 1 person failed. Conversely, in the non- dentures group, 2 individuals passed the test successfully, whereas 6 individuals experienced failure. The Fisher Exact test yielded significant results (p=0.041). These data indicate statistically significant results in favor of swallowing safety in the non- denture group. The results are shown in Table 3.

Table 3. Comparison of swallowing safety.

Parameters	**Dental prosthesis (n = 8)**		**Non-dental prosthesis (n = 8)**		***p***
	n	**%**	**n**	**%**	
Acute Stroke Dysphagia Screen					
Passed	7	87,5	2	25	0,041
Failed	1	12,5	6	75	

Fisher Exact test, %: Percentage

Discussion

The results of this study aimed to evaluate patients with dentures but not utilizing them in intensive care conditions in terms of swallowing safety. The findings indicated that these individuals had a lower risk of aspiration compared to individuals who did not utilize dentures. Although not statistically significant, it is also noteworthy that the group with dentures but restricted use, which had a slightly higher stroke severity, was more successful in swallowing. The oral cavity is one of the densest regions of the body in terms of mechanoreceptors [36]. A substantial amount of sensory input allows the oral phase of swallowing to be carried out and the required information to be transferred to the pharyngeal phase [37,38]. Sensory reception of the oral region is provided by the teeth, tongue, oral mucosa and facial skin. Periodontal ligaments which contain dense mechanoreceptor endings, another important structure for oral sensation, connect the teeth to the jaw bones. They transmit signals according to the forces reflected on the tooth they support and the physical properties of these forces [39]. These properties enable them to adjust the force applied by the teeth based on the physical properties of the bolus during chewing [40]. Periodontal ligament receptors do not function in conditions such as tooth loss and denture use [41]. It has also been reported that both aging and tooth loss can change tactile and pain perception in the oral cavity [42]. For this reason, individuals using dental prostheses have difficulty in distinguishing the forces applied to the teeth and surrounding tissues and their swallowing may be affected [43].

Oral anesthesia has been reported to slow swallowing and prolong intervals between swallowing in healthy adults [44]. Similarly, oral anesthesia has been reported to delay the triggering of pharyngeal swallowing, which increases the risk of aspiration [45]. The oral perceptual process, which relies on sensory inputs and is based on the processing and

interpretation of these inputs by cognitive processes, is affected in individuals with stroke. In a previous study, it was revealed that individuals with stroke in the acute phase with impaired oral perception were more at risk in terms of swallowing safety [46].

Studies show that oral apparatus that may affect oral sensation and perception may also affect swallowing. It has been reported that individuals with palatal coverage experience an acute decrease in bolus formation ability, chewing performance, and difficulty swallowing [47]. It has been suggested that this is caused by a reduced sensory area (gingiva and hard palate if there is a covering) and altered oral anatomical shape [48]. It has also been reported that the number of chews during the oral phase increases in elderly individuals using prostheses [49]. In our study conducted in intensive care patients, only liquid was used as a bolus when testing swallowing safety. In addition, when compared to individuals without dentures, it can be said that when denture wearers remove their dentures, they have more receptor area due to the increased soft tissue areas covering the teeth. Because when individuals routinely use their dentures, both the dentures and the coverings obscure the receptor areas in the oral region. When these implements are removed, there is a relative increase in receptor areas compared to the previous state. Additionally, compared to individuals with natural teeth, the areas without teeth in edentulous individuals can serve as receptor areas. The results contradict with the findings of previous studies that the use of dental prosthesis brings with it the risk of swallowing disorder in subacute stroke [31]. We attribute this disparity to variations in the disease duration, differences in assessment methods, and the types of bolus employed across the studies. While the results of the assessment with a liquid bolus in individuals with prostheses during the acute phase are superior to those without prostheses, it's essential to note that this observation is applicable only in the early stages of the disease and specifically with a liquid bolus. It remains essential to conduct further assessments with various bolus types following discharge from intensive care conditions. In addition, the results of this study suggest that when individuals with dentures are tested for oral feeding of non-chewable bolus types in the intensive care setting, they should be evaluated with and without dentures, and based on the results, a decision should be made to use dentures during the consumption of non-chewable foods.

Limitations: It was necessary to re-administer the swallowing tests performed on individuals who have dentures, this time with the individuals utilizing their dentures, in order to comprehend the impact of denture use more clearly. However, we opted not to conduct additional swallowing evaluations due to the potential risk of food material aspiration during these assessments. Since only liquid food was used during the swallowing assessment, this observation applies only to the liquid bolus type. Furthermore, our strict inclusion criteria related to cognition led us to exclude many individuals and affected our sample size.

Conclusion

The use of dentures can affect oral sensation. Removing dentures and palatal coverings, if covarage present, and testing individuals in this manner appears to have provided them with an advantage due to the relatively increased sensory areas. Undoubtedly, covering the receptor areas in the mouth with various implements affects the sensory process and may influence swallowing safety. But according to our study findings, it may be

beneficial for individuals to avoid using denture that they routinely use. There are many factors affecting swallowing function, making it difficult to generalize this judgment. However, during routine intensive care swallowing assessments, we believe individuals using dentures should be tested both with and without prostheses when evaluating swallowing with liquids and semi-solid foods. While our study sheds light on the clinical implications of denture use, further research on how dentures impact oral sensation remains an interesting topic for exploration.

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