



RESEARCH

Development of an intensive care oral care frequency assessment scale

Özlem Doğu Kökcü PhD, BSN, Assistant Professor¹ |
Banu Terzi PhD, BSN, Assistant Professor²

¹Faculty of Health Sciences, Sakarya University, Sakarya, Turkey

²Faculty of Nursing, Fundamentals of Nursing Department, Akdeniz University, Antalya, Turkey

Correspondence

Banu Terzi, Assistant Professor, Faculty of Nursing, Fundamentals of Nursing, Akdeniz University, Akdeniz Üniversitesi Dumlupınar Bulvarı, Akdeniz Üniversitesi Yerleşkesi Konyaaltı, 07070, Antalya, Turkey.
Email: copurbanu@hotmail.com; banuterzi@akdeniz.edu.tr

Abstract

Background: Oral care and frequency of oral care is important for intensive care patients in order to prevent the risk of ventilator-associated pneumonia. However, there are no scales to assess the frequency of oral care specific to intensive care units (ICUs).

Aims and Objectives: This study aimed to develop a valid and reliable tool, "Intensive Care Oral Care Frequency Assessment Scale (ICOCFAS)", for assessing the frequency of nurses' oral care in critical ill patients.

Design: This was an instrument development study.

Methods: The validity and reliability of the ICOCFAS, which consists of nine items, were tested using content validity (five expert opinions), construct validity (factor analysis), item analysis, and internal consistency analysis methods. The population of the research consisted of inpatients at the ICU of a hospital in Sakarya, Turkey. The research was conducted with 73 patients in the ICU.

Results: Expert opinions on the content validity indicated that the scale was admissible. The Kaiser-Meyer-Olkin (KMO) coefficient was calculated at 0.800, and the Chi-square value of the Bartlett test was considerably significant ($\chi^2 = 270.539$; $P < .001$). Using a path diagram in confirmatory factor analysis, Chi-square/df ratio values were calculated as 1.49, standardized root mean square residual as 0.077, comparative fit index as 0.97, and root mean square error of approximation as 0.082. Cronbach's alpha was 0.851. The correlations between the items and total scores were 0.455 to 0.835 and were statistically significant ($P < .001$).

Conclusions: The ICOCFAS is an efficient tool with high validity and reliability for assessing oral care frequency in the ICU.

Relevance to clinical practice: The ICOCFAS is a valid and reliable tool for Turkish society for assessing the frequency of oral care of patients in the ICU. It is recommended for various national and international studies with different patients in ICUs.

KEYWORDS

intensive care patients, nursing care, oral care frequency, reliability, validity

1 | INTRODUCTION

Personal hygiene habits, past problems related to oral health, and the hospitalization process might negatively affect patients' oral health by damaging the mucous membrane and causing the formation of dental plaque and biofilm.¹⁻³ Common practices of care and treatment in the intensive care unit (ICU) (intubation, mechanical ventilation, oro-/nasogastric tubes, insufficient or ineffective oral care, etc.) and the clinical status of the patient (hyperthermia, sepsis, stress, non-oral nutrition, deficient liquid volume, dehydration, etc.) might lead to some serious diseases, such as ventilator-associated pneumonia (VAP), by accelerating the colonization of oropharynx by micro-organisms.^{2,4} It is known that approximately 65% of the intubated intensive care patients have VAP-responsible pathogens in their oral mucosa and dental plaques.⁵ The death rate has been reported to decrease by 43% and VAP rate by 75% among intensive care patients following efficient oral care.⁶ Thus, oral care is significantly important for ICU patients, and it is the primary element of nursing care for these units.^{2,4}

However, patient-specific oral care provided by evaluating oral care frequency for patients in critical care is generally a neglected subject.¹

It is known that oral care is effective in the intensive care process in preventing ICU-acquired infections, mainly VAP, and accelerating recovery and discharge.^{7,8} Therefore, defining oral mucosal problems and their potential complications and providing patient-specific oral care by identifying the frequency of care is important for the ICU. However, no gold-standard assessment tool was found that evaluates ICU-specific oral mucosa as a whole and identifies patient-specific oral care frequency.^{4,9-11} A study by Hanneman and Gusick¹² states that oral care is performed more frequently on intubated patients in the ICU compared with the non-intubated patients, and it is performed 2.3 ± 1.7 times in every 12 hours on average. A study by Alotaibi et al,⁵ conducted with 215 intensive care nurses, states that there are differences in the frequency of oral care among nurses, even between the nurses in the same ICU. A study by Celik and Eser¹³ states that ICU nurses perform oral care 1.52 ± 1.15 times per day on average and do not use any kind of oral care assessment tool or protocol. Another study conducted in Turkey reports that, among ICU nurses, 44.5% perform oral care less than four times a day, 32.6% perform oral care when it is needed, and 22.7% perform oral care every 2 to 4 hours.¹⁴ Oral mucosa assessment tools in the literature are mostly developed for geriatrics and patients with cancer or chronic diseases^{8,9,15-17}; applying these tools to critical patients in the ICU is quite difficult.¹⁸ Neurological diagnosis, diagnosis of trauma, long-term intubation, and tools placed in oral mucosa prevent assessing the oral mucosa of ICU patients by fully opening their mouth.¹³ On the other hand, patients with agitation or delirium might interfere with the oral care assessment process with a biting response. Furthermore, factors such as nurse-patient rate, inadequacy of oral mucosal assessment, time loss, the fact that oral care is on the bottom of the nursing intervention list, and a lack of ICU-specific oral care assessment protocols might also prevent the use of oral mucosal assessment tools.^{13,19}

WHAT IS KNOWN ABOUT THIS TOPIC

- Oral care in ICUs is one of the main functions of nursing care.
- No assessment tool is available in the literature that measures the frequency of oral care specific for intensive care patients.

WHAT THIS PAPER CONTRIBUTES

- The ICOCFAS is a valid, reliable measurement tool with efficient psychometric characteristics for determining the frequency of oral care of patients in intensive care.
- It is recommended to use and test ICOCFAS with different national and international samples.

A study by Dale et al¹⁸ discusses the difficulties in oral care of critical, intubated, adult patients under three headings. These difficulties are visualizing oral space ($n = 318$, 74.3%), obtaining patient co-operation ($n = 236$, 55.1%), and inserting instruments into mouth ($n = 222$, 52.9%).¹⁸ Dental plaque tends to accumulate in posterior teeth (molars and premolars), which is not easily observed and reached by nurses. Patients are admitted to the ICU with already existing oral health problems. Maintaining patients' oral care can be difficult when artificial airway and nutrition tools are placed inside the oral space.^{20,21}

In the literature, while there are no intensive care patient-specific tools to assess the frequency of oral care, there are some tools developed to assess oral health. Beck's Oral Assessment Tool, developed by Beck (1979) for oncology patients, assesses lips, gums and mucosa, tongue, teeth, and saliva using 1 to 4 points. The total score that can be obtained from this tool ranges between 0 and 20. A total score of 0 to 5 suggests oral care in at least every 12 hours, and a score of 16 to 20 suggests oral care in at least every 4 hours.^{16,22} It is suggested that this tool can be used by nurses for the oral care assessment of the critical patients in the ICU.²² Eilers' Oral Assessment Guide (OAG) is also one of these tools. This tool, which was mainly developed for oncology patients at the beginning, is used for identifying oral health status and the frequency of oral hygiene measures in eight categories (swallow, lips, tongue, saliva, mucous membranes, gingiva, teeth, and voice). Each category is scored from 1 (best) to 3 (worst).^{1,23,24} "BRUSHED" is another oral assessment tool developed by Hayes and Jones, which is a simple mnemonic tool. This tool allows the assessment of oral mucosa as "Yes" or "No" in terms of Bleeding (B), Redness (R), Ulceration (U), Saliva (S), Halitosis (H), External factors (E), and Debris (D).^{25,26}

In the literature, there are some tools that completely evaluate oral mucosa (oral cavity, tongue, oral plate, teeth, etc.) However, none of these tools were developed specifically for intensive care patients. On the other hand, while there is no evidence supporting the optimal

frequency of oral hygiene of the critical patients in the ICU, according to the consensus statement, there is a suggestion to brush teeth at least twice a day.²

Accordingly, the aim of this study was to develop a valid and reliable tool that enables the determination of oral care frequency by holistically assessing the oral mucosa specific to the patients in the ICU.

1.1 | Aims and research questions

The aim of this study was to develop a valid and reliable tool “Intensive Care Oral Care Frequency Assessment Scale (ICOCFAS)” to assess the frequency of nurses’ oral care of critical ill patients in ICUs. The research sought answers to the following questions:

- Is the assessment scale developed for assessing oral care frequency for the ICU a valid scale?
- Is the assessment scale developed for assessing oral care frequency for the ICU a reliable scale?

2 | METHODS

2.1 | Design

The study was a methodologic study designed to develop a valid and reliable tool ICOCFAS to assess the frequency of nurses’ oral care of critical ill patients in ICUs.

2.2 | Setting and sample

The research was conducted between December 2018 and May 2019. The population and sample of the research consisted of patients in the third-level ICU of a university hospital in Sakarya, a city to the west of Turkey. The evaluation parameters of the scale consisted of nine items. The research was completed with a total of 73 patients in the ICU without sample calculation and by following the rule in literature which states that the sample size must be 5 to 10 times the number of items on the scale for validity and reliability analyses.²⁷ The inclusion criteria were receiving care and treatment in the ICU, requiring oral care, being aged 18 years and older, receiving invasive and non-invasive mechanical ventilation treatment, and obtaining consent from the conscious patients themselves or the relatives of unconscious/sedated patients. Patients or patients’ families who did not give permission for the research and patients who were not suitable for oral care were not included in the research. The study was completed with a total of 73 patients.

2.3 | Data collection tools

Data were obtained using a Patient Information Form, the ICOCFAS, and the Brushed Model Oral Assessment Guide.

2.3.1 | Patient information form

The form questioned the patients’ sociodemographic characteristics such as age, gender, smoking history, teeth brushing habits, and interventions in the ICU—such as existence of intubation tube and use of sedation and also duration of hospitalization in the ICU.

2.3.2 | Intensive care oral care frequency assessment scale

The scale was prepared by the researchers who have experience in intensive care by performing an extensive literature review.^{2,5,8,9,16,20-27} The scale questioned nine parameters: age, lips, teeth, tongue, oral mucosa, saliva, cheeks, nutritional support, and ventilatory support. Each parameter was evaluated separately as Normal = 1 point, Mild = 2 points, Moderate = 3 points, and Severe = 4 points. The total of the scores obtained for each parameter gave the total ICOCFAS score. An additional 1 point was added to the total score for each condition in the event of broad-spectrum antibiotic or steroid treatment, diabetes mellitus diagnosis, low haemoglobin (Hb) concentration, and immunosuppressive drug use. Oral care frequency was determined according to the total score.

The ICOCFAS indicates that “9 points: oral care at least once every 12 hours;” “10-19 points: oral care at least once every 8-12 hours;” “20-29 points: oral care at least once every 6 hours;” and “30 points and above: oral care at least once every 4 hours.” Frequency of oral care increases as the total score obtained from ICOCFAS increases. In the 48 hours following admission to ICU, oropharyngeal flora of the critical patients changes from predominantly Gram-positive organisms to predominantly Gram-negative organisms, creating a more virulent flora. This bacterial flora might move towards lungs and cause serious infections related to health care services such as VAP.^{20,28} The importance of oral care in the ICU can be understood more clearly by considering the tools and medications used for care and treatment at ICU and the fact that the critical patients in the ICU are unable to perform self-oral care.^{24-26,28,29} On the other hand, while there are no absolutes on the frequency of oral care, dentists suggest that healthy individuals should brush their teeth twice a day. In some studies, it was observed that oral mucosa recovered following the oral care performed in every 2, 3, and 4 hours.²⁹ Critical care guides suggest that ICU patients should receive oral care every 2 to 4 hours, and deep oropharyngeal suctioning should be applied after.³⁰ Frequency of oral care should be specific to individuals. Frequency of oral care should be determined by considering the diagnosis and treatment methods. In this direction, ICOCFAS, a valid and reliable tool for identifying the frequency of oral care, which also includes ICU-specific assessment of oral mucosa, was developed.

2.3.3 | BRUSHED model oral assessment guide

The guide, which was developed by Hayes and Jones,²⁵ evaluates oral mucous membranes in terms of factors such as bleeding, redness,

ulceration, saliva, and halitosis. The parameters are scored as "present" and "absent." This tool was used for the comparisons with ICOCFAS as it is easily applicable by all of the nurses in the ICU.

2.4 | Data collection process

Data were collected in three stages.

1. Formation of scale items: The parameters of ICOCFAS were prepared based on the literature,^{2,11,16,22,23,25,29,31} knowledge, and the researchers' observations during their intensive care nursing experience.

2. Expert opinion: ICOCFAS was presented to five intensive care nursing experts who were asked to evaluate each item as "Not appropriate," "Needs correction," "Needs a little correction," and "Appropriate."

3. Application: Unclear statements in each assessment parameter in ICOCFAS were corrected according to the expert opinions. Related images were added to some statements in the scale for a better understanding. For the pilot study, the finalized scale was used on 10 patients in the ICU. It took approximately 10 to 15 minutes to complete the scale.

Oral care is performed twice a day in the ICU where the research was conducted. Oral care kits (oral care sponge swabs, oral rinse with chlorhexidine, and lip moisturiser), which were available in the ICU according to the hospital policy, were used for oral care. Nurses were asked to evaluate the oral care needs of patients using ICOCFAS before performing oral care. An Oral Assessment Guide was prepared to ease nurses' use of the assessment tool.

The guide includes information on how to assess the lips, tongue, palate, and oral mucous membranes in terms of moisture and structure and states which examination methods and tools to use for assessing saliva and deglutition. Nurses used this guide while using ICOCFAS. They were asked to plan the next oral care for the patients in accordance with the total scores obtained from ICOCFAS.

2.5 | Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki. Written ethics committee approval was obtained from Sakarya University Faculty of Medicine (permission no. March 28, 2018–04). Consent was obtained from the patients/patients' relatives. All patients were included in the research on a voluntary basis.

2.6 | Data analysis

Data were analysed using the Statistical Package for the Social Sciences for Windows Version 23.0 (SPSS) and IBM SPSS Analysis of Moment Structures (AMOS 23.0). According to the Law of Large Numbers, for numeric variables, the distribution of sample averages is closer to normal distribution for $n \rightarrow \infty$.³² Descriptive statistics (n, %)

are given for categorical variables. Expert opinions ($n = 5$) were taken to evaluate the intelligibility of the items and to determine if ICOCFAS covered the subject to be measured. These expert opinions were evaluated using Kendall' W analysis.^{33–36}

To test sample competency and if the data were compatible with the sample group for construct validity before factor analysis, the Kaiser-Meyer-Olkin (KMO) test and Bartlett Sphericity test, which shows the correlation of items, and descriptive and confirmative factor analysis (ECA-CFA) were used. Correlation-based item and internal consistency analyses were conducted for reliability.^{33–36}

3 | RESULTS

The average age of the patients included in the research was 64.75 ± 13.81 (Min. = 19–Max. = 100) years. The majority (64.4%) ($n = 47$) were males. The ICOCFAS' psychometric properties' results are discussed under three headings:

3.1 | Content validity of the scale

The evaluations that five different experts made for the scale items were found to be statistically concordant ($W = 0.776$, $P < .001$). Therefore, no changes were made to the scale items.

3.2 | Construct validity of the scale: Factor analysis

Exploratory factor analysis (EFA) of the scale was tested using factor analysis and confirmatory factor analysis (CFA). At the first stage of the factor analyses, KMO and Bartlett tests were used to check if the data obtained from the pilot applications of the scale were compatible with factor analysis. The KMO coefficient was calculated as 0.800, and the Chi-square value of the Bartlett test was found to be considerably significant ($\chi^2 = 270.539$; $P < .001$). A KMO value greater than 0.60 and significant Bartlett test results indicate that data are suitable for analysis.^{32,37}

According to Table 1, there were two factors with eigenvalues greater than 1. If the explained variance rate of the first eigenvalue in a single factorial model is greater than 0.30, it could be said that the scale is a single factorial scale.^{38,39} Accordingly, it could be said that this scale was a unidimensional scale because the variance explained by the first factor was 0.48. The fact that the slope graph given in Figure 1 has no sharp break points also supports this result. All the factor loads of the scale items were greater than 0.30, which indicates that scale items made a sufficient contribution to the factor.

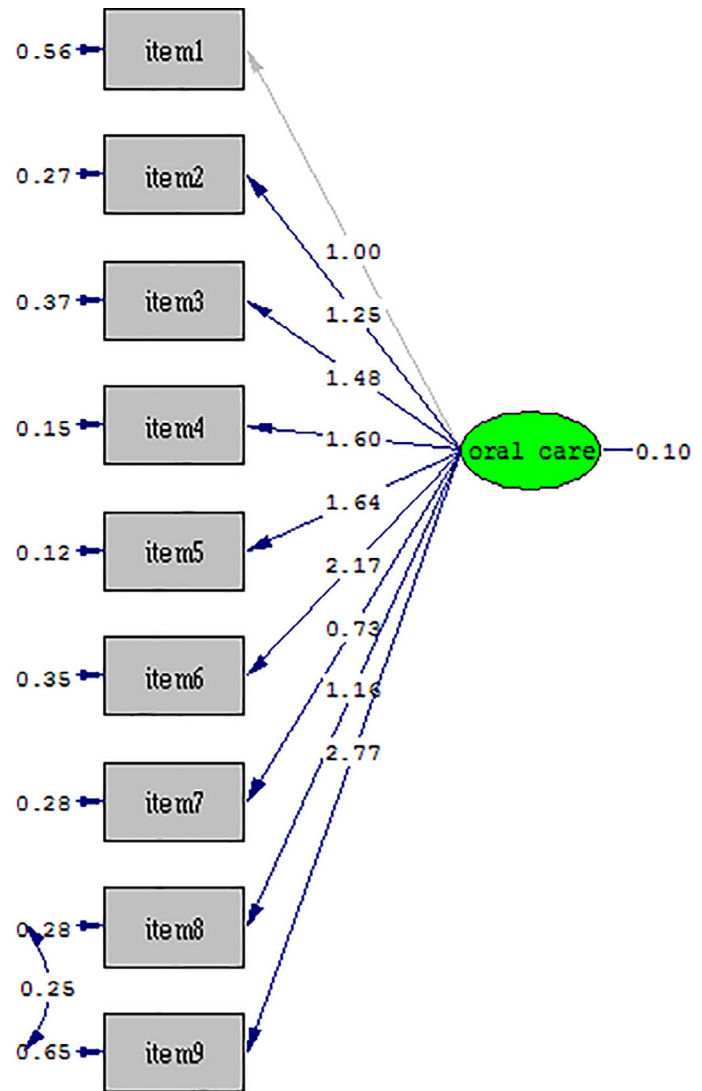
Fit indices for the unidimensional CFA model were examined. According to the results, the scale's single factorial structure consisting of nine statements generally fitted well. The robust maximum likelihood method was used for analyses because deviations from normal were observed when examining the assumptions of the analysis. The track diagram obtained is given in Figure 1.

TABLE 1 Eigen value, stated variance percentages, and item factor loads of intensive care oral care frequency assessment scale

Parameters	Factor loads	Variance percentage	Eigen value
Oral mucosa	0.833	48.245	4.342
Ventilatory support	0.830		
Tongue	0.798		
Saliva	0.762		
Nutritional support	0.692		
Teeth	0.687		
Lips	0.643		
Cheeks	0.457		
Age	0.411		

Factor extraction method: Principal components analysis

FIGURE 1 Unidimensional, first-degree CFA Model. RMSEA, root mean square error of approximation; CFA, Confirmatory factor analysis. Item 1: Age, item 2: lips, item 3: teeth, item 4: tongue, item 5: oral mucosa, item 6: saliva, item 7: cheeks, item 8: nutritional support, item 9: ventilatory support



Chi-Square=38.72, df=26, P-value=0.05183, RMSEA=0.082

Figure 1 shows that the factor loads (normalized factors) were at an acceptable level, between 0.39 and 0.80. Error variances of items 8 and 9 were correlated to make a modification. At the last stage, fit indices were examined for the unidimensional first-degree CFA model.

The scale's single factorial structure consisting of nine parameters was found to fit well in general. Fit values obtained indicated a generally acceptable and good-level model-data fit. According to this, Chi-square/degree of freedom (*df*) was calculated as 1.49, the

standardized root mean square residual (SRMR) was calculated as 0.077, the adjusted Goodness-of-Fit index (AGFI) was calculated as 0.75, the Comparative Fit Index (CFI) was calculated as 0.97, and the root mean square error of approximation (RMSEA) was calculated as 0.082. Consequently, it could be said that the hypothetical structure of the scale was identified with EFA, which is acceptable by theoretical verification.

3.3 | Reliability of the scale

Following factor analysis, Cronbach's alpha coefficient for identifying the reliability of the scale with nine items was calculated as 0.851. It may be stated that internal consistency was high because this value was close to 1, which is the upper limit of reliability. Moreover, according to Pearson's correlation analysis, the correlation coefficient between the scores obtained from ICOCFAS and the BRUSHED Model Oral Assessment Guide was found to be considerably significant ($r = 0.791$; $P < .001$).

The total mean score of the scale items ranged between 1.33 and 3.11, and standard deviations were in the range of 0.58 to 1.19. Correlations between the items and total scores were in the range of 0.455 to 0.835 and were statistically significant ($P < .001$). This indicates that the scale items were highly consistent with the scale.

4 | DISCUSSION

Intensive care nurses play an important role in assessing and maintaining the oral health of patients in critical conditions. Valid and reliable oral care assessment tools and evidence-based oral care protocols might reduce the risk of infections such as VAP, which occurs because of invasive mechanical ventilation, a commonly used treatment intervention in the ICU.^{40,41} However, because of the institution policies in our country, it is not possible to strictly follow patient care protocols in ICUs. On the other hand, no scale has been developed to decide the ICU-specific oral care frequency. The optimum oral care frequency for patients in ICUs is a subject that merits further investigation. Valid and reliable measurement tools are needed for this investigation. Therefore, in order to determine the oral care frequency of critical care patients in ICUs by assessing the oral mucosa, the ICOCFAS, which consists of one dimension and nine items, was developed. The data of the research are discussed under three headings:

4.1 | Content validity of ICOCFAS

For scale development studies, "content validity" evaluates if the scale items cover the desired area to be measured.^{27,38} Opinions were obtained from five experts to evaluate the suitability of the ICOCFAS items (two intensive care head nurses, two associate professors of nursing, and one professor of nursing). Items that were unclear

according to the expert opinions were corrected. Images were placed at the bottom of the scale for the unclear parts regarding the assessment of the tongue and oral mucosa.

4.2 | Construct validity of ICOCFAS: Factor analysis

Validity is a measure of whether the scale truly reflects the desired parameter. Construct validity is one of the criteria for validity testing, and it is related to what the measured scale is.⁴¹ The most commonly used method for testing the construct validity of a scale is factor analysis. In our study, each item was evaluated by itself in terms of total score correlations. In our study, as a result of the Varimax Rotation process of the scale, a similar dimension with similar characteristics was obtained. The fit indices calculated within the scope of CFA, especially the result that Chi-square/ df was less than 5, the SRMR value was less than 0.1, and the RMSEA value was 0.082, indicated that the scale was compatible at an acceptable level.⁴²⁻⁴⁵

4.3 | Reliability of the scale

The fact that Cronbach's alpha coefficient of the scale and its dimension were at a good level suggested that half of the variance (48.24%) was explained; Cronbach's alpha value was high, and therefore, the scale was valid and reliable. This result states that the correlation of the scale items with unidimensional theoretical structure is statistically significant.³⁷ According to the analyses performed for the reliability of the scale, the result that there was a significant and high-level accordance between different scales indicated that the items measured corresponded to similar statements. As a result of the research, it was concluded that the ICOCFAS had valid, reliable, and adequate psychometric characteristics.

Tools and medicine used for the care and treatment of the critical patients in ICUs might lead to some serious infections such as VAP by damaging the oral mucosa of these patients.^{15,20,24} Thus, providing comprehensive oral care by evaluating the oral mucosa in detail is important in the ICU.^{2,3,7,11,15,46} Preservation or recovery of oral mucosa depends on the frequency of oral care.²⁹ Frequency of oral care might differ by the clinical status of the patient (current disease, tools placed inside mouth, nutrition, medication, etc.) and the need for oral care.^{12,24} Patient-specific, valid, and reliable oral mucosa evaluation tools should be used. Although there are oral care evaluation tools in literature,^{16,17,22,23,25} these tools might remain limited for both evaluating oral mucosa and identifying the frequency of oral care. For this reason, a tool that will be a guide for identifying the frequency of oral care by comprehensively evaluating the oral mucosa of the critical patients in ICU is needed. ICOCFAS, which was developed with this aim, is a valid and reliable tool that can be easily applicable by nurses to identify the frequency of oral care for the critical patients at ICU.

5 | LIMITATIONS

Not being able to apply the test-retest method because the daily evaluation of the scale might be affected because the oral mucosal structures of patients in the ICU could change, obtaining the opinions of only five experts, and generalization of the research only to the sample group are the limitations of the research.

6 | IMPLICATIONS AND RECOMMENDATIONS FOR PRACTICE

Although oral care is a commonly applied nursing practice, there are no measurement tools to measure the oral care frequency specific for patients who receive care and treatment in these units. On the other hand, assessment of the oral mucosa is difficult in patients in ICUs. Differences in institution policies and the ICU nurses' inability to translate evidence-based knowledge into practice are also important limitations.

The ICOCFAS is a valid and reliable measurement tool for Turkish society, which will guide nurses in deciding oral care frequency in the ICU. It is believed that the ICOCFAS will fill the gap regarding the assessment of oral care frequency in ICUs. Tools and guides to assess ICU-specific oral care should be developed in order to comfort patients by regularly and efficiently performing oral care. The ICOCFAS should be tested with different ICUs and groups of patients, compared in terms of factors affecting oral care, and experimental studies should be conducted.

7 | CONCLUSION

The ICOCFAS is a valid and reliable measurement tool specific for Turkish society. The scale can be applied to international studies by providing language and society adaptations. Appropriate and effective approaches could be developed for deciding the frequency of oral care of patients in the ICU with the total score obtained from the scale. Besides using the scale for the patients receiving care and treatment in the ICU, it is recommended for use in different groups of patients by making comparisons.

ORCID

Banu Terzi  <https://orcid.org/0000-0002-9500-6872>

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