

Effect of Oral Care Protocol on Oral Health Status among Mechanically Ventilated Patients

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Abstract

Background: The use of oral hygiene approaches is vital for maintaining the health and comfort of patients. This is especially true for those in intensive care who are intubated and on mechanical ventilation because proper oral hygiene practices greatly reduce the possibility of complications and shorten hospital stays for such patients. **Aim:** The aim of this study is to evaluate the effect of oral care protocol on oral health status among mechanically ventilated patients. **Research Design:** A quasi-experimental study with one group pre-test and post-test design was utilized for the current study. **Setting:** The study was carried out in the intensive care unit at Cairo university hospital. **Sample:** A purposive sample of (30) male and female patients admitted to the ICU. **Tools of data collection:** Two tools were utilized to collect data pertinent to the current study: tool (1) patient's demographic and medical data sheet, tool (2) Beck oral assessment score (BOAS) modified. **Results:** There is a significant decrease in total mean oral health score post intervention in the 3 days which indicates that there is an improvement in the oral status after oral care, there is a significant decrease in mean oral health score post intervention for all BOAS subscales, the teeth and saliva were the most subscales improved after the intervention. **Conclusion:** The oral health status of mechanically ventilated patients improved after the intervention of oral care. **Recommendations:** Applying oral care for mechanically ventilated patients, the oral health condition of intubated patients should be frequently assessed in the ICU utilizing oral assessment tools as a basis for intervention.

Keywords: Oral care protocol, oral health status, mechanically ventilated patients

Introduction

A variety of factors, such as endotracheal intubation, malnutrition, and fluid loss through fever, diarrhea, and reduced fluid intake, cause patients admitted to intensive care units (ICUs) to develop oral difficulties quickly (Atashi, et al., 2018). The oral mucosa can also become dry as a side effect of taking medications such as beta-blockers, bronchodilators, antihistamines, diuretics, and anti-hypertension (xerostomia). The oral health of intubated patients in the ICU may deteriorate due to these situations, which may raise the risk of oral infections and ventilator-associated pneumonia (VAP) (Dale, et al., 2013).

Additionally, due to poor perfusion and drug toxicity, stratified epithelium cells beyond the lips and into the oropharynx of intensive care patients can easily be destroyed. Therefore, it is essential to provide and maintain oral care for patients in critical care in order to prevent developing changes in the oral mucosa, oral issues brought on by inadequate oral care, and ventilator-associated pneumonia (VAP) (Atashi, et al., 2018).

All patients who are mechanically ventilated require routine oral care. The oropharyngeal mucosa's integrity is preserved by oral care, which also makes people more comfortable. The CDC advises that every intensive care unit develop a comprehensive oral care program with the use of an antibiotic

oral rinse to avoid oral colonization since an intact mucosa aids in preventing infection and colonization of organisms that cause VAP (Munro, et al., 2009). (Tablan, et al., 2004).

Apply water-based mouth moisturizer to preserve the integrity of the oral mucosa, clean the mouth with antibacterial solutions and alcohol-free mouthwash, and thoroughly suction oral and subglottic secretions. One substance that has antibacterial effect and is utilized in many institutions is chlorhexidine mouth rinse (Morton & Fontaine., 2017). Since it has a high level of antibacterial, antiviral, and antifungal activity, chlorhexidine gluconate.2% has been recognized as the gold standard solution for oral care patients in the intensive care unit (Depaola & Spolarich, 2007; Nicolosi et al., 2014).

For an unconscious patient or patient in ICU, nurses have a crucial role in encouraging dental hygiene and delivering excellent oral care (Ram, John, & Thomas, 2020). Most critically ill patients become less conscious and unable to meet their fundamental demands. In order to preserve dental health and avoid infection, oral care interventions should be given (Morton & Fontaine, 2013). The oral care program one of the techniques to reduce VAP in ICU, according to the Centers for Disease Control and Prevention (CDC), the American Association of Critical Care Nurses (AACN), and the Institute for Healthcare Improvement (IHI) (Pear et al., 2007). Additionally, Heo et al. (2008) noted that because VAP is linked to bacterial colocalization the mouth and oropharynx, keeping good dental health is crucial for preventing its onset.

Significance of study

Although dental care is a crucial component of nursing, it has both immediate and long-term effects on patients' health, comfort, and well-being. Even when oral problems are obvious, providing sufficient oral care for patients in intensive care units (ICUs) is exceptionally difficult, frequently missed, and rarely given priority in nurses' daily activity plans.

In order to maintain the health of the oral cavity and overall health, hospitalized patients need to practice effective and regular oral hygiene. Additionally, it will aid in the creation of a database about this issue to be included in the future plan of care for this group of patients and it may attract and inspire additional studies in this field.

Aim of the study

The aim of this study is to evaluate the effect of oral care protocol on oral health status among mechanically ventilated patients.

Research Hypothesis

To fulfill the aim of this study the following research hypothesis was formulated:

H1: There will be no difference in oral health status for mechanically ventilated patients between pre-intervention and post-intervention assessment.

Subject and method

Research Design

A quasi-experimental study with one group pre-test and post-test design was utilized for the current study. The one-group pretest-posttest design is a type of quasi-experiment in which the outcome of interest is measured two times: once before and once after exposing a non-random group of participants to a certain intervention/treatment (Reichardt, 2019).

Setting

The study was carried out in the intensive care unit at Cairo university hospitals. It provides intensive medical and surgical care to critically ill patients and contains 17 beds.

Sample

A purposive sample of (30) male and female patients admitted to the intensive care unit was included in the current study. The inclusion criteria: adult orally intubated patients after 12 hrs. from connection to the mechanical ventilation, conscious and

unconscious, in the age group 18- 65 years. Patients who shifted on a tracheostomy tube during the study, haven't teeth, or have maxillary trauma are excluded. The sample size was calculated based on the following formula: $Z = 1.96$, $e = 0.05$, $p = 0.5$

$$n = \frac{z^2 * p * (1-p) / e^2}{1 + \frac{z^2 * p * (1-p)}{e^2 * N}}$$

Tools

To fulfill the aim of the study two tools were utilized to collect data pertinent to the current study as follows:

1- Patient's Demographic and Medical Data Sheet: It was developed by the researchers and covered data related to age, sex, admission diagnosis, past medical history, and admission date.

2- Beck Oral Assessment Score (BOAS) modified: It was created by Becks in 1979 to evaluate the oral cavity and to check the effectiveness of oral care.

Scoring system:

BOAS consisted of five subscales, including lips, gingiva and mucous membranes, tongue, teeth, and saliva. The rating of each subscale has a range of scores from one to four. The minimum total score of BOAS is 5, while the highest score is 20. The higher score indicates the patient's oral health status is getting worse, as regards BOAS Interpretation it was as follows:

5 =no dysfunction, 6-10=mild dysfunction, 11-15=moderate dysfunction, 16-20=sever dysfunction.

Validity and Reliability

The content validity of the developed was reviewed by a panel of 5 experts in the field of critical care and emergency nursing in order to ensure content comprehensiveness, clarity, relevance, and applicability.

The BOAS, a standardized assessment tool for the oral health status of intubated

patients in the ICU, has been validated by specialists in dentistry, surgical medical nursing, and critical care nursing. It has been shown to be valid and reliable, with interrater reliability of .92 and a correlation coefficient of .84 (Handa et al., 2014).

Pilot study:

A pilot study was conducted on 10% (n=3 patients) to evaluate the feasibility of the instruments, their clarity as well as to estimate the time needed for filling the data collection instrument.

Ethical Considerations

Official permission to conduct the study was obtained from the Research Ethics Committee, Faculty of Nursing, Cairo University (RHDIRB 2019041701 & FWA 00026458). Also, official permission was obtained from hospital administrators to conduct the study. Informed consent was obtained from the patient's relatives. Anonymity and confidentiality are assured through coding the data, subjects were assured that this data not be reused in another research without their permission; data collected was used for the purpose of the research only and the entire needed sample in the study followed until analyzed. All information taken was protected.

Procedures

The research was conducted in three phases: preparation, intervention, and evaluation phases.

Preparation phase:

This phase was concerned with designing, adopting, and constructing the different study tools. Official approval was granted from the Scientific Research Ethics Committee to proceed with the study then approval was obtained from the administrative authorities of the hospital to carry out the study. The nature and purpose of the study were explained by the researchers for the patient's relatives who meet the inclusion criteria.

Intervention phase:

The patient's demographic and medical data sheet (tool 1) was filled out by the researchers, then the Beck Oral Assessment Score (tool 2) was implemented for all included patients before and after the intervention. The oral care was performed every 12 hours for three consecutive days. The first step was performed hand washing, then prepared the needed equipment (mask, sterile gloves suction catheter, chlorhexidine gluconate, soft pediatric toothbrush, sterile gauze, suction source, and sterile plastic cup), the procedure was explained to the patients and their relatives, then applied the personal protective equipment (PPE) and put the patient in a high fowler position, then put a towel or tissue paper on the patient's chest and oropharyngeal suction was done, after that assessed the oral cavity, and lips. The oral care was done using a combination of tooth brushing and swabbing techniques with 20-cc chlorhexidine gluconate. Tooth brushing was done by using a soft pediatric toothbrush while swabbing using sterile gauze. The direction of the toothbrush started from the upper left of the teeth to the right, then from the lower right teeth to the lower left part of the gingiva. After that, the tooth was brushed in the lingual part. Tooth brushing was done for at least 2 minutes. The tongue was brushed from the back to the front carefully to avoid moving the ETT. Then swab on the buccal and ETT tube utilizing sterile gauze with chlorhexidine gluconate. In the end, performed oropharyngeal suction was done, the equipment was disposed, removed the PPE, hand washing and documentation was done, the data collected from November to December 2022.

Evaluation Phase: The researchers evaluated the effect of oral care at the end of 3 consecutive days..

Statistical analysis

Data entry and statistical analysis were done using SPSS 26 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations, Chi-square, T-Test used for compares the actual difference between two means in relation to the variation in the data.

Results:

Table (1) shows that more than half (53.3%) of the studied sample were males, with a mean age of 56.0 ± 13.6 , the majority (83.3%) of them were married. Regarding the level of education, about one third (33.3%) of them had preparatory education. The majority (76.7%) of the studied sample were nonsmokers.

Table (2) reveals that, less than one third (23.3%) of the studied sample were diagnosed with intestinal obstruction, half (50%) of them hadn't comorbidities diseases. Regarding of mechanical ventilation, more than half of them (56.7%) of them were connected with mechanical ventilation for 4 days and more than two thirds (63.4%) of them were on SIMV mode.

Table (3) clarifies that, a decrease in mean oral health score post intervention in all days for all BOAS subscales which indicates that there is an improvement in oral status after oral care.

Table (4) indicates that, there is a significant decrease in total mean oral health score post intervention in the 3 days which indicates that there is an improvement in oral status after oral care.

Table (5) shows that, there is a significant decrease in mean oral health score post intervention for all BOAS subscales, the teeth and saliva were the most subscales improved after the intervention.

Table (6): reveals that, there is a significant decrease in moderate dysfunction

and increase in mild dysfunction after intervention.

Table (1): Frequency Distribution of the Studied Patients According to their Demographic Data (N=30)

Variables	No	%	Variables	No	%
Gender			Marital Status		
Male	16	53.3	Single	2	6.7
Female	14	46.7	Married	25	83.3
Age			Divorced	3	10.0
20-<40	3	10.0	Education		
40-<60	9	30.0	Illiterate	9	30.0
60-<80	18	60.0	Secondary	9	30.0
Mean ± SD	56.0	±13.6	Primary	2	6.7
Smoking			Preparatory	10	33.3
Yes	7	23.3			
No	23	76.7			

Table (2): Frequency Distribution of the Studied Patients According to their Medical Data (N=30)

Variables	No.	%	Variables	No.	%	Variables	No.	%
Diagnosis			Comorbidities			Number of days on mechanical ventilation		
Gangrene	3	10.0	Renal disease	1	3.3	4 days	17	56.7
Acute abdomen	3	10.0	Diabetes	13	43.3	5 days	4	13.3
Motor car accident	2	6.7	Hypertension	1	3.3	6 days	3	10.0
Intestinal obstruction	7	23.3	no	15	50.0	7days	2	6.7
Stroke and shock	4	13.3	Mode of mechanical ventilation			8 days	4	13.3
Respiratory disorders	5	16.7	CMV	10	33.3			
Cardiovascular and renal disorders	6	20.0	SIMV	19	63.4			
			CPAP	1	3.3			

Table (3): Beck Oral Assessment Subscales for the Studied Sample (N=30)

Days	Total oral health Score			
	Pre intervention	Post intervention	t	p
	Mean ± SD	Mean ± SD		
Day 1	11.87 ±2.82	9.19 ±3.49	3.271	0.002*
Day 2	10.55 ±2.91	8.04 ±2.99	3.295	0.002*
Day 3	9.43 ±2.95	7.06 ±2.55	3.329	0.002*

*significant at p-value<0.05

Table (4): Difference between the Means of Oral Health Score at Different Assessment Times (N=30)

Items	First day		Second day		Third day	
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Lips	2.40 ±0.62	1.94±0.63	2.08±0.56	1.65±0.51	1.87±0.49	1.53±0.56
Gingiva and oral mucosa	2.37 ±0.52	1.92±0.71	2.08±0.51	1.57±0.57	1.73±0.55	1.41±0.49
Tongue	2.27 ±0.54	1.85±0.65	2.03±0.59	1.52±0.53	1.90±0.64	1.42±0.49
Teeth	2.35 ±0.65	1.78±0.73	2.11±0.61	1.56±0.65	1.98±0.53	1.35±0.48
Saliva	2.48 ±0.50	1.70±0.78	2.23±0.65	1.75±0.73	1.95±0.74	1.35±0.53
Total	11.87 ±2.82	9.19±3.49	10.55±2.91	8.04±2.99	9.43±2.95	7.06±2.55

Table (5): Difference between BOAS Subscales:

BOAS Subscales	Scores		t	p
	Pre intervention	Post intervention		
	Mean \pm SD	Mean \pm SD		
Lips	2.12 \pm 0.56	1.71 \pm 0.57	2.810	0.007*
Gingiva and oral mucosa	2.06 \pm 0.53	1.63 \pm 0.59	2.970	0.004*
Tongue	2.07 \pm 0.59	1.60 \pm 0.56	3.165	0.002*
Teeth	2.15 \pm 0.60	1.56 \pm 0.62	3.745	0.0001*
Saliva	2.22 \pm 0.63	1.60 \pm 0.68	3.663	0.001*

*significant at p-value<0.05

Table (6): Difference between BOAS Total Score:

Level	Total oral health level				Chi-square	p
	Pre -intervention		Post -intervention			
	No.	%	No.	%		
No dysfunction	0	0.0	1	3.3	1.00	0.32
Mild dysfunction	12	40.0	24	80.0	4.00	0.049*
Moderate dysfunction	18	60.0	5	16.7	7.35	0.01*

*significant at p-value<0.05

Discussion:

For critically ill patients in the ICU, oral care is an essential practice. The health of intensive care patients as well as the clinical outcome may be impacted by oral care (**Atay & Karabacak, 2014**). The main objectives of oral care are to encourage good oral hygiene, decrease dental plaque and microbial colonization of the oropharynx, and prevent the aspiration of contaminated saliva (**Feider, Mitchell, & Bridges, 2010**).

Regarding the demographic and medical data for the studied patients, the findings of the current study showed that the mean age of 56.0 ± 13.6 , less than one third of them were diagnosed with intestinal obstruction, in relation to mechanical ventilation, more than half of them were connected with mechanical ventilation for 4 days, these findings are supported by **Khasanah, Sae-Sia, Damkliang (2019)** who studied the effectiveness of oral care guideline implementation on oral health status in critically ill patients, mentioned that mean age of patient participants was 48.43 years, most of the patient participants were post-surgery, most of them connected with mechanical ventilators for 1 to 3 days.

The current study revealed that there is a significant decrease in moderate dysfunction and increase in mild dysfunction after the intervention. This finding is in agreement with **M Sai, Jobby, Claudia (2020)** who studied effects of oral care protocol and practices of nurses on oral assessment scores in the ventilated patients. according to boas scores found that 15 (60%) patients had no dysfunction and 10 (40%) patients had mild dysfunction. It was revealed that, existing oral care protocol was effective and compliance of staff adherence to protocol was satisfactory.

Furthermore, the finding of the current study revealed that there is a significant decrease in mean oral health score post intervention for all BOAS Subscales which indicates that there is an improvement in oral status after oral care, this finding is consistent with **Estaji et al. (2015)** who studied the comparison of chlorhexidine solution and swab with toothbrush and toothpaste effect on preventing oral lesions in hospitalized patients in intensive care unit, and reported that using toothbrushes and chlorhexidine was effective in preventing oral lesions. However, they reported that using toothbrushes compared to chlorhexidine led to better improvement of the patient's oral health and had a significant effect on reducing oral lesions. In the same line **Rujipong, P. (2009)** who investigate the effect of using an oral care clinical nursing practice guideline on oral hygiene status and ventilator-associated pneumonia in intubated patients after receiving oral care, the participants in experimental group had a significant lower mean score of abnormality of oral hygiene status than those in the control group ($p < .05$).

The previous findings are contradicted by **Prendergast et al. (2012)** who studied the effects of a standard versus comprehensive oral care protocol among intubated neuroscience ICU patients: results of a randomized controlled trial, and indicated that there was a significant increase in scores of intubated patients despite oral care intervention. Unlike the case with the three BOAS subscales, the tongue subscale obtained no significant differences in the assessment before and after oral care, and there was an improvement in the teeth subscale.

Limitations of the study

The current study was conducted in only one ICU with a small sample size, therefore the potential for generalization may be limited.

Conclusion:

The oral health status of mechanically ventilated patients improved after the intervention of oral care.

Recommendations:

Based upon the findings of the current study, the following are recommended: applying oral care for mechanically ventilated patients, the oral health condition of intubated patients should be frequently assessed in the ICU utilizing oral assessment tools as a basis for intervention.

Acknowledgment:

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Conflict of Interest:

No conflict of interest was declared by the authors.

References

- Atashi V, Yazdannik A, Mahjobipoor H, Yousefi H, Bekhradi R.(2018).** The Impact of Systematic Oral Care on Oral Health Status in Patients of Intensive Care Units. *JHC.*; 20 (3) :244-251
URL: <http://hcjournal.arums.ac.ir/article-1-869-en.html>. doi:10.29252/jhc.20.3.244.
- Atashi V, Yousefi H, Mahjobipoor H, Bekhradi R, Yazdannik A. (2018).** Effect of Oral Care Program on Prevention of Ventilator-associated Pneumonia in Intensive Care Unit Patients: A Randomized Controlled Trial. *Iran J Nurs Midwifery* Nov-Dec;23(6):486-490. doi: 10.4103/ijnmr.IJNMR_164_17. PMID: 30386400; PMCID: PMC6178571.
- Atay, S., & Karabacak, U. (2014).** Oral care in patients on mechanical ventilation in intensive care unit: Literature review. *International Journal of Research in Medical Sciences*, 2, 822–829. doi:10.5455/2320-6012.ijrms20140876
- Beck, S. (1979).** Impact of a systematic oral care protocol on stomatitis after chemotherapy. *Cancer nursing*, 2(3), 185-200.
- Dale, C., Angus, J. E., Sinuff, T., & Mykhalovskiy, E. (2013).** Mouth care for orally intubated patients: a critical ethnographic review of the nursing literature. *Intensive and Critical Care Nursing*, 29(5), 266-274. <https://doi.org/10.1016/j.iccn.2012.09.003>
- DePaola, L. G., & Spolarich, A. E. (2007).** Safety and efficacy of antimicrobial mouthrinses in clinical practice. *American Dental Hygienists' Association*, 81(suppl 1), 117-117.
- Estaji Z, Alinejad M, Hassan Rakhshani M, Rad M.(2015).** The Comparison of Chlorhexidine Solution and Swab With Toothbrush and Toothpaste Effect on Preventing Oral Lesions in Hospitalized Patients in Intensive Care Unit. *Glob J Health Sci.* 2015;8(5):211–6. doi: 10.5539/gjhs.v8n5p211.
- Feider, L. L., Mitchell, P., & Bridges, E. (2010).** Oral care practices for orally intubated critically ill adults. *American Journal of Critical Care*, 19, 175–183. doi:10.4037/ajcc2010816
- Grap, M. J., Munro, C. L., Hamilton, V. A., Elswick Jr, R. K., Sessler, C. N., & Ward, K. R. (2011).** Early, single chlorhexidine application reduces ventilator-associated

- pneumonia in trauma patients. *heart & lung*, 40(5), e115-e122.
- Handa, S., Chand, S., Sarin, J., Singh, V. A., & Sharma, S. (2014).** Effectiveness Of Oral care Protocol on Oral Health Status Of hospitalised children admitted in Intensive Care Units of selected hospital of Haryana. *Nursing & Midwifery Research Journal*, 10(1), 8-15.
- Heo, S. M., Haase, E. M., Lesse, A. J., Gill, S. R., & Scannapieco, F. A. (2008).** Genetic relationships between respiratory pathogens isolated from dental plaque and bronchoalveolar lavage fluid from patients in the intensive care unit undergoing mechanical ventilation. *Clinical Infectious Diseases*, 47(12), 1562-1570.
- Khasanah IH, Sae-Sia W, Damkliang J. (2019).** The Effectiveness of Oral Care Guideline Implementation on Oral Health Status in Critically Ill Patients. *SAGE Open Nursing*;5. doi:10.1177/2377960819850975
- M Sai Ram, Jobby John , Claudia Thomas. (2020).** Effects of Oral Care Protocol & Practices of Nurses on Oral Assessment Scores in the Ventilated Patients. *International Journal of Nursing Care*, 8(2), 21–23. <https://doi.org/10.37506/ijonc.v8i2.11279>
- Morton, P. G., & Fontaine, D. K. (2013).** *Essentials of critical care nursing a holistic approach.* Wolters Kluwer Health| Lippincott Williams & Wilkins.
- Morton, P.G., & Fontaine, D.K. (2017).** *Comprar Critical Care Nursing. A Holistic Approach 11th Ed.* | Patricia Gonce Morton | 9781496375162 | Lippincott Williams & Wilkins.
- Munro, C. L., Grap, M. J., Jones, D. J., McClish, D. K., & Sessler, C. N. (2009).** Chlorhexidine, toothbrushing, and preventing ventilator-associated pneumonia in critically ill adults. *American journal of critical care*, 18(5), 428-437.
- Nicolosi, L. N., del Carmen Rubio, M., Martinez, C. D., González, N. N., & Cruz, M. E. (2014).** Effect of oral hygiene and 0.12% chlorhexidine gluconate oral rinse in preventing ventilator-associated pneumonia after cardiovascular surgery. *Respiratory care*, 59(4), 504-509.
- Pear, S., Stoessel, C. K., & Shoemaker, S. (2007).** The role of oral care in the prevention of hospital-acquired pneumonia. *Infection Control Today*, 11(10), 1-3.
- Prendergast, V., Jakobsson, U., Renvert, S., & Hallberg, I. R. (2012).** Effects of a standard versus comprehensive oral care protocol among intubated neuroscience ICU patients: results of a randomized controlled trial. *Journal of Neuroscience Nursing*, 44(3), 134-146. <https://doi.org/10.1097/JNN.0b013e3182510688>
- Ram, M. S., John, J., & Thomas, C. (2020).** Effects of Oral Care Protocol & Practices of Nurses on Oral Assessment Scores in the Ventilated Patients. *International Journal of Nursing Care*, 8(2), 21.
- Reichardt C., S., (2019).** *Quasi-Experimentation: A Guide to Design and Analysis.* The Guilford Press
- Rujipong, P. (2009).** The Effect of Using an Oral Care Clinical Nursing Practice Guideline on Oral Hygiene Status and Ventilator-Associated Pneumonia in Intubated Patients. *J Nurs Sci Vol.27 No.3*

S2 Sep-Dec 2009 Journal of Nursing
Science

**Tablan OC, Anderson LJ, Besser R, Bridges
C, Hajjeh R; CDC; Healthcare Infection
Control Practices Advisory Committee.
Guidelines for preventing health-care--**

associated pneumonia, 2003:
recommendations of CDC and the
Healthcare Infection Control Practices
Advisory Committee. MMWR Recomm
Rep. 2004 Mar 26;53(RR-3):1-36. PMID:
15048056.