Inter-Rater Reliability of the Mallampati Classification for Patients in a Dental Hygiene Clinic

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Abstract

Purpose: The purpose of this study was to assess the inter-rater reliability between dental hygiene students and a supervising dentist using the Mallampati classification to evaluate and classify the pharyngeal soft tissues.

Methods: A sample of 234 patients volunteered for the study. Mallampati classifications were performed by 21 dental hygiene students for patients during a 12 month period. During that same time period, the clinic dentist performed an independent assessment on the same patients. Quantitative research methods were used to evaluate the inter-rater reliability between dental hygiene students and the clinical dentist in performing the Mallampati classification. The data was analyzed using adjusted McNemar test for non-independent data, Kappa score and percentage of agreement with 95% bootstrap confidence interval.

Results: There was an agreement between the dental hygiene student and the dentist in the majority of the independent assessments with a p-value=0.498 from the adjusted McNemar test. Inter-rater agreement measured by Cohen's Kappa coefficient was 0.54 with a 95% bootstrap confidence interval of 0.42, 0.64. The percentage agreement was around 77% with a 95% confidence interval of 72%, 82%.

Conclusion: It was concluded that dental hygiene students can evaluate and classify the pharyngeal soft tissues comparable to a supervising dentist in the clinical dental hygiene setting.

Keywords: mallampati classification, obstructive sleep apnea, clinical dental hygiene education, inter-rater reliability

This study supports the NDHRA priority area, **Clinical Dental Hygiene Care:** Investigate how dental hygienists identify patients who are at–risk for oral/systemic disease.

Introduction

Obstructive sleep apnea (OSA) is a condition characterized by a partial or complete closure of the airway, resulting in repeated episodes of breathing cessation during sleep.[1] The restriction of oxygen during these episodes is known as hypoxia and can last from several seconds to several minutes in length. The repeated hypoxia episodes can lead to severe systemic consequences including hypertension, stroke, arrhythmias, cardiovascular disease or even death.[2,3] OSA is a condition that may affect up to 1 in 5 adults.[4,5] A definitive diagnosis of OSA is only obtained from polysomnography that involves an overnight stay in a sleep laboratory. The sleep study is used to identify the presence of OSA as mild, moderate or severe. Nearly 80% of all moderate to severe cases of OSA in middle age men and women are undiagnosed.[6] Dental hygiene students may be able to play an active role in the early identification of risk factors for OSA.

The role of the dental professional can begin with recognition, referral and management of sleep disorders. The Mallampati score was shown to be progressively higher in patients who exhibited more severe degrees of OSA as determined by polysomnography.[7,8] There are several intraoral traits that OSA patients exhibit including macroglossia, narrow palate, wide uvula, hypertrophy of the tonsil region and a narrow opening of the oropharynx.[9,10] The Mallampati classification is a tool used by anesthesiologists prior to surgical procedures to identify patients who may have difficulty during endotracheal intubation.[11] This scoring system uses a scale of I, II, III, IV (Figure 1) in identifying patients who may be at risk for a difficult intubation.[8] A score of I represents the greatest visibility of the posterior pharynx with the mouth open and tongue protruded, and IV shows the least visibility. Patients with a grade III or IV Mallampati classification are at greater risk of having a difficult airway for endotracheal intubation because of the limited opening of the oropharynx.[11]

Physical characteristics for OSA include obesity, male gender, age, a neck circumference greater than 17 inches for men and 16 inches for women and a retrognathic profile.[12-14] Symptoms associated with OSA include snoring, headaches, xerostomia and bruxism. Xerostomia has been identified as an oral complication due in part to the open mouth episodes experienced during the night.[2,12] Bruxism has

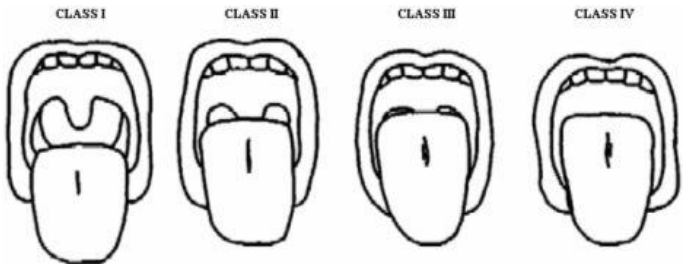
been identified in patients with OSA. The grinding of teeth, which take place during the arousal episodes, is associated with sudden arousals from the obstruction.[13] Of particular concern is the gender differences associated with risk factors for sleep apnea.[5,15] For example, men present with large tonsils a wide uvula and high tongue where as women with large tonsils and a retrognathic profile were more likely to have OSA.[9]

There are systemic and social consequences associated with OSA. The episodes of hypoxemia and arousals lead to hypertension, atherosclerosis, stroke, cardiac arrhythmias, heart failure and pulmonary hypertension.[16] Daytime symptoms include daytime sleepiness, fatigue, difficulties with concentration or memory, and depression.[2,14] Daytime sleepiness leads to an increase in accidents and loss of work production.[17,18]

There are several treatment options for OSA patients. The most common is the use of a continuous positive airway pressure (CPAP) machine. The CPAP is used during sleep to open the airway and prevent obstruction by the soft tissues in the oral cavity. Mandibular Advancement Devices (MAD) are appliances worn during sleep to reposition the mandible anteriorly to open the airway. CPAP and MAD may be used concurrently to treat OSA. In severe cases of OSA, surgery may be indicated. Surgical procedures may include reduction of soft tissue surrounding the oropharynx, orthognathic surgery and maxillomandibular advancement. However, the ultimate cure for OSA is tracheostomy.

Research shows dental professionals are receiving inadequate training to screen for sleep related disorders.[19–21] Medical and dental school curriculum includes limited hours toward the training in the identification and treatment of sleep related disorders.[21,22] Likewise, dental hygienists receive minimal training, if any, to identify the oral signs related to sleep related disorders. There are a number of methods to screen and evaluate patients for sleep disorders. Simple questionnaires that screen for daytime sleepiness and risk factors for OSA such as the Epworth Sleepiness Scale or STOP Questionnaire are available as a first line screening tool. However, there are numerous methods to assess physical characteristics related to sleep disorders.[23,24] Dental hygienists are taught to perform a very thorough oral examination on every patient and are in a unique position to identify risk factors for OSA and make appropriate referrals. Dental professionals are in an ideal position to evaluate and classify the pharyngeal soft tissues. The researchers utilized the Mallampati classification during the oral assessment to classify the pharyngeal soft tissues.

Figure 1: Mallampati Classification



There is little data to demonstrate the use of the Mallampati classification by dental hygienists in the clinical setting. The purpose of this study was to assess the inter-rater reliability between dental hygiene students and a supervising dentist using the Mallampati classification to evaluate and classify the pharyngeal soft tissues.

Methods and Materials

Twenty-one second year dental hygiene students agreed to participate in this study, which was approved by the Youngstown State University Institutional Review Board. Informed consent was obtained from the dental hygiene students and the clinic patients to participate in this study. Prior to beginning the project, a pilot study was conducted on a small sample of students to test the methods. This study was conducted in the Dental Hygiene Clinic at Youngstown State University. Data was collected during 3 semesters from May 2010 to May 2011. The dentist and dental hygiene students were trained by a licensed respiratory therapist on the proper method to determine Mallampati classification. They were shown an illustration of the 4 classifications. The therapist demonstrated the proper technique for performing this evaluation. Both the dentist and the dental hygiene students were instructed to sit the patient upright in the dental chair, and to use the dental light to look into the patients open mouth without phonation.

During the oral exam the students were given a diagram of the Mallampati classification (Figure 1) and were instructed to place a check mark next to the appropriate image that corresponded to the patients' oropharynx opening. The clinic dentist was trained by the same licensed respiratory therapist to accurately perform the same exam with the same recording criteria. The dentist conducted an independent evaluation of the patients' Mallampati classification on a separate but identical form. These forms were color-coded, numbered and labeled to differentiate between the student and dentist evaluations. Each patient was given a number identifier that was used on all forms. Both the student and dentist deposited the forms in a locked box in the clinic upon completion of the evaluation. All of the examinations were

conducted on clinic patients during clinical time as part of the intraoral and extraoral examination. There was no discussion among the students and dentist before, during or after the recording of the Mallampati classification. The data was then analyzed using the SAS statistical software.

Results

During the 1 year period of data recording, the study collected 234 independent pairs of observations from the participants, with 18 incomplete cases that were eliminated from the study. Among the records observed, 15% (36) were collected from the summer term, 46% (107) from the fall semester and 39% (91) from the spring semester. Since the critical scores to separate normal and abnormal status is between the scores of II and III, the Mallampati classification was coded as normal if the score was II or less, and coded as abnormal if the score was III or higher, for kappa statistic computation. The agreement percentage and the McNemar test were also computed based on this recoded data.

The inter-rater agreement classification table for the students and dentists from the recoded data is shown in Table I. Among all the cases recorded, 109 (46.6%) were identified as normal from both dentist and student, and 72 (30.1%) were identified as abnormal by both dentist and student. Student raters observed multiple patients which made the rating data non-independent, therefore the adjusted McNemar test using Durkalski's method was used for testing the agreement in Mallampati ratings between students and dentist, and the bootstrapping method was used for examining the correlation between ratings.[25-27] The p-value from the adjusted McNemar test is 0.498 which indicates that, statistically, there is no significant difference between the students' and dentists' ratings on patients. The Spearman's correlation coefficient is 0.54 with a 95% bootstrap confidence interval (0.50, 0.64) and p-value<0.001, which indicates significant correlation in Mallampati ratings on patients between students and the dentist. The kappa score is 0.54 with a 95% bootstrap confidence interval (0.42, 0.64), which is considered as satisfactory in the strength of agreement between students' ratings and dentists' ratings.[28,29] The percentage of agreement is around 77% with a 95% confidence interval (72%, 82%) which is a good strength of inter-rater agreement between the students and the dentist.

Table I: Classification Table for Mallampati Scores Between Students and Dentists

		Student Recorded Classification		
		Normal	Abnormal	Total
Dentist Recorded Classification	Normal	109*	29	138
	Abnormal	24	72*	96
	Total	133	101	234

*Percentage of agreement: (109 + 72)/234=77%.

Discussion

The results of this study indicate that dental hygiene students can evaluate and classify oropharyngeal tissues. The results show a 77% agreement between the dentist and the students. This indicates that students could accurately differentiate between normal and abnormal Mallampati classifications. Dental hygiene students learn to assess patients for xerostomia, bruxism, condition of the oral pharynx and the tongue. By incorporating an assessment of the oropharyngeal tissues into the oral examination, the dental hygiene student can recognize patients that may have undiagnosed OSA.

The impact OSA has on systemic, social and personal well being cannot be overestimated. Occupational accidents related to daytime sleepiness prompted the National Transportation Safety Board to issue a recommendation to screen truck drivers and bus drivers, commercial pilots, train engineers and merchant sailors for sleep apnea.[30] Early recognition and treatment of OSA has been recognized as a significant way to reduce health care utilization costs.[31] When OSA is left untreated, the risk for mortality increases.[32,33] The dental profession can begin to make an impact on undiagnosed cases of OSA.

Research has found there is a lack of information regarding the prevalence of OSA in dental and dental hygiene curricula. A study reported in the American Academy of Sleep Medicine reports that even though dental schools are including OSA in the curriculum, the number of hours is not sufficient.[21,34] Another survey of dentists' knowledge, opinion, education, resources, cooperation and clinical practice regarding OSA reports a lack of instruction in dental schools.[19]

The dental profession should be aware of risk factors and symptoms of OSA and have an opportunity to recognize, refer and treat patients.[35,36] Dental hygienists currently use risk assessments during a routine dental hygiene exam to recognize conditions and factors that predispose a patient to systemic conditions or diseases. By incorporating the Mallampati classification into the oral assessment performed by the dental hygienist a consultation with the dentist for further assessment may lead to referral to the patient's primary care physician to expedite early diagnosis and treatment of OSA.

This study has several limitations. The purpose of this study was to measure whether dental hygiene students could accurately record the Mallampati classification in the clinical dental hygiene setting. Dental hygiene students and the clinic dentist were included in this project because they were directly involved in patient contact in the dental hygiene clinic. For convenience, the clinic dentist was chosen to be the standard by which the students were measured. Repeating the study using an expert in the use of the Mallampati classification such as an anesthesiologist to compare with the student results may have resulted in a different outcome. Secondly, this study was designed so that students and the clinic dentist were provided with the same training on the use of the Mallampati classification scoring system. Students were instructed to position their patient in an upright position, tongue protruded and with no phonation to record the Mallampati classification. The dentist recorded the Mallampati classification at a convenient time during the appointment with the same patient positioning criteria. The dental hygiene students nor the dentist were observed by the researchers during the recording of the Mallampati classifications which could have led to inaccurate positioning of the patient and may explain the difference in student and dentist reporting results. Lastly, there were records omitted from the final data analysis due to student and/or dentist reporting errors.

It is important for the dental hygienist to recognize that collaboration with other health professionals can lead to expanding their role in assessment methods to aid in early identification of risk factors associated with systemic conditions. This study is an example of collaboration between respiratory therapy and dental hygiene to incorporate the use of the Mallampati classification into the oral assessment. The use of the Mallampati classification in this setting can be useful in screening for OSA. Such collaboration can lead to new approaches in preventative health care. Future research should include investigation of the expanding role of the dental professional in the recognition of risk factors associated with OSA.

Conclusion

This investigation demonstrates that dental hygiene students have the necessary skill to perform the Mallampati classification. Furthermore, results show that dental hygiene students could accurately identify patients that fell into the Mallampati classification between II and III. A classification of I or II is not associated with an airway indicating OSA but a classification of III or IV is associated with an airway indicating risk for OSA. The students' ability to accurately identify III and IV classifications as they did in this study is important in identifying OSA risk. Lastly, additional education and training is needed for dental hygiene students to increase their knowledge and recognition of risk factors for OSA and use of oral assessment methods and techniques to classify oropharyngeal tissues.

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