An Observational Study for the Comparison of Upper Lip Bite Test with the Measurement of Thyromental Distance for the Prediction of Difficult Intubation

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ABSTRACT:

Introduction: Difficulties in laryngoscopy and tracheal intubation occur in 1.5% to 13% of patients undergoing general anesthesia, presenting a persistent concern for anesthesiologists. The Upper Lip Bite Test (ULBT) and Thyromental Distance (TMD) represent distinct methods for preoperative airway assessment. While ULBT evaluates temporomandibular joint movement, TMD measures the distance between the laryngeal prominence and the mental protuberance. This observational study aims to systematically compare the effectiveness of ULBT and TMD in predicting difficult intubation, contributing valuable insights for refining preoperative airway assessment protocols.

Aim and Objective: The aim is to compare the Upper Lip Bite Test with the measurement of thyromental distance for the prediction of difficult intubation. The objective is to compare the sensitivity, specificity, positive predictive value, and negative predictive value of ULBT and TMD for predicting difficult intubation.

Materials and Methods: This prospective, observational, single-blind study involved thirty patients scheduled for elective intubation. ULBT and TMD assessments were conducted during preoperative evaluation, and difficulty prediction was recorded. Laryngoscopic views were documented post-induction using the Cormack Lehane classification. Inclusion criteria encompassed age, consent, ASA grades I and II, and elective surgery; exclusion criteria included refusal, airway history, tumors, and restricted mobility.

Results: The comparative analysis between ULBT and TMD for predicting difficult and easy intubation. ULBT exhibited perfect sensitivity (100%) and high specificity (96.4%), with a positive predictive value of 66.7% and a negative predictive value of 100%. TMD showed 60% sensitivity, 96% specificity, a positive predictive value of 75%, and a negative predictive value of 92.3%.

Conclusion: The study concludes that ULBT, assessing temporomandibular joint movement, outperforms TMD in predicting difficult intubation. Incorporating ULBT into routine preoperative assessments enhances patient safety. A nuanced approach, considering patient-specific factors, is crucial. Future research should explore larger populations for generalizability. This study contributes valuable insights to anesthesia practice, aiding clinicians in informed decision-making for airway assessments.

1. Introduction

Difficulties in laryngoscopy and tracheal intubation are observed in 1.5% to 13% of patients undergoing general anesthesia, posing a perennial concern for anesthesiologists[1]. The Upper Lip Bite Test (ULBT) serves as an indicator of temporomandibular joint movement, encompassing various factors like weight,

head and neck mobility, jaw movement, receding mandible, and buck teeth. In cases involving jaw subluxation along with buck teeth, ULBT is anticipated to provide a more reliable predictive value for assessing a difficult airway[2]. ULBT categorizes patients into three classes: Class I indicates the ability to elevate lower incisors above the vermilion line; Class II denotes the upper lip below the vermilion line; and Class III signifies the inability to bite the upper lip.

Another approach for predicting a difficult airway involves measuring the thyromental distance (TMD). This measurement entails the distance between the laryngeal prominence of the thyroid cartilage and the mental protuberance of the mandible. A TMD equal to or less than 6 cm is considered indicative of potential difficulty in intubation[3].

The Upper Lip Bite Test (ULBT) and the measurement of thyromental distance (TMD) are two distinct methods employed in the preoperative assessment of airway management. The ULBT, which evaluates temporomandibular joint movement, encompasses factors such as weight, head and neck mobility, jaw movement, receding mandible, and the presence of buck teeth. On the other hand, TMD involves measuring the distance between the laryngeal prominence of the thyroid cartilage and the mental protuberance of the mandible.[4] Despite their utility, a comparative evaluation of the ULBT and TMD for predicting difficult intubation is essential for refining preoperative airway assessment protocols. This observational study aims to systematically compare the effectiveness of the Upper

Lip Bite Test with the measurement of thyromental distance in predicting difficult intubation. The findings of this study hold the potential to contribute valuable insights to the existing literature, guiding clinicians in selecting the most reliable preoperative tool for anticipating challenges in airway management. Such knowledge is crucial for enhancing patient safety, optimizing resource utilization, and improving overall clinical outcomes in the practice of anesthesia.

The aim of the present study was to compare upper lip bite test with the measurement of thyromental distance for the prediction of difficult intubation.

2. Materials and Methods:

Following approval from the institutional ethical committee, this prospective, observational, single-blind study was conducted to assess the sensitivity, specificity, and positive and negative predictive values of the Upper Lip Bite Test (ULBT) in comparison to Thyromental Distance (TMD) for the prediction of difficult intubations.

A cohort of thirty patients scheduled for elective intubation underwent evaluations using both the Upper Lip Bite Test and thyromental distance during the preoperative assessment. The anticipation of intubation difficulty was recorded before anesthesia induction. Subsequently, laryngoscopic views were documented post-induction of anesthesia using the Cormack Lehane classification.

Inclusion Criteria:	Exclusion Criteria:
Patients who were willing to provide written and informed consent. Patients of either gender aged between 18 and 60 years. Patients classified under the American Society of Anesthesiologists grades I and II. Patients scheduled for elective surgery under general anesthesia necessitating endotracheal intubation.	Patient refusal to participate in the study. Patients with a prior history of airway burn or trauma. Patients presenting with tumors or masses in the laryngeal, facial, and cervical regions. Patients exhibiting restricted mobility of the neck and mandible.

Both ULBT and TMD assessments were conducted during the preoperative evaluation. Intubation difficulty was predicted based on the results of these assessments. Following the preoperative evaluation, anesthesia was induced as per standard protocols. Post-induction, the laryngoscopic view was recorded using the Cormack Lehane classification.

There are four grades in the Cormack Lehane classification:

Grade I: Visualization of the entire glottis, including the vocal cords. Represents an unobstructed and clear view.

Grade II: Visualization of the posterior part of the glottis, including the arytenoid cartilages. The vocal cords are

still visible but may not be as clearly defined as in Grade I.

Grade III: Visualization of only the epiglottis. The epiglottis is seen, but the vocal cords are not visible.

Grade IV: No visualization of any part of the glottis. This represents a situation where the epiglottis cannot be lifted, and no portion of the glottis is visible.

The Cormack Lehane classification provides a standardized way to communicate the difficulty of laryngoscopy. A lower grade indicates easier visualization of the airway, while a higher grade suggests increased difficulty and potential challenges during intubation.

Statistical analysis was performed to determine the sensitivity, specificity, and positive and negative predictive values of the ULBT compared to TMD for predicting difficult intubations. Descriptive statistics were employed to summarize demographic data and relevant clinical characteristics.

3. Results:

Table 1: Comparative Analysis of Upper Lip Bite Test and Thyromental Distance for Predicting Intubation Difficulty

	Upper lip Bite test			Thyromental distance		
	Difficult intubation	**Easy intubation**		**Difficult intubation**	**Easy intubation**	
Predicted Difficult	2	1	3	1	4	5
Predicted Easy	0	27	27	1	24	25
Total	2	28	30	2	28	30

Figure 1: Comparative Analysis of Upper Lip Bite Test and Thyromental Distance for Predicting Intubation Difficulty
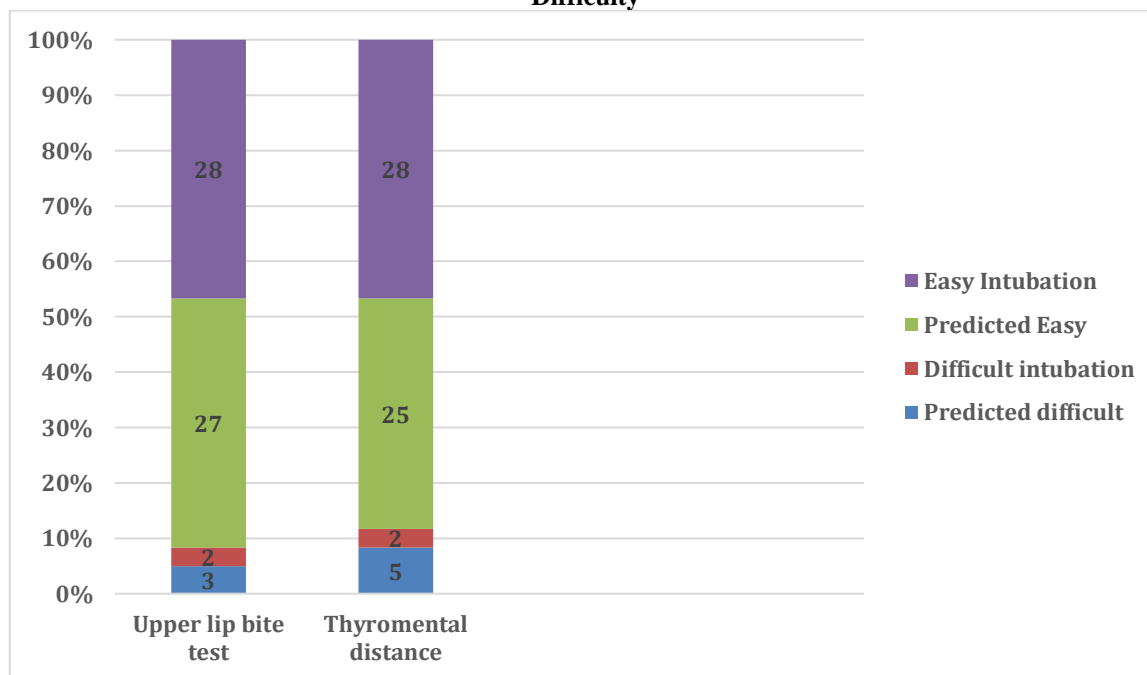

Table 1 shows the results of the comparative analysis between the Upper Lip Bite Test (ULBT) and Thyromental Distance (TMD) for predicting difficult and easy intubation are outlined in the contingency table. For the ULBT, it demonstrated perfect sensitivity (100%) and high specificity (96.4%), correctly identifying all cases of difficult and easy intubation. The positive predictive value was 66.7%, and the negative predictive value was 100%. On the other hand, TMD exhibited 60% sensitivity, 96% specificity, a positive predictive value of 75%, and a negative predictive value of 92.3%. These findings suggest that the ULBT is particularly effective in ruling out difficult intubation cases, while TMD shows a somewhat better ability to identify cases where intubation may pose a challenge.

Table 2: interpretation of the performance metrics for the Upper Lip Bite Test (ULBT) and Thyromental Distance (TMD) in predicting intubation difficulty

	ULBT	TMD
Sensitivity	100%	50%
Specificity	94.44%	77.78%

Positive Predictive Value	66.67%	20%
Negative Predictive Value	100%	93.33%
Accuracy	95%	75%

The table 2 presents a comprehensive assessment of the predictive performance of the Upper Lip Bite Test (ULBT) and Thyromental Distance (TMD) in identifying difficult intubation cases. Notably, ULBT demonstrates exceptional sensitivity (100%), accurately identifying all instances of difficult intubation. Additionally, it exhibits a high specificity of 94.44%, indicating its proficiency in correctly recognizing cases without difficult intubation. The positive predictive value of ULBT is 66.67%, emphasizing its reliability in predicting actual difficult intubation cases. Moreover, ULBT achieves a perfect negative predictive value (100%), suggesting its ability to accurately exclude cases without difficult intubation. Overall, ULBT attains an impressive accuracy of 95%, making it a robust tool for predicting intubation difficulty. In contrast, TMD shows a lower sensitivity (50%) and specificity (77.78%), resulting in a reduced positive predictive value (20%) and accuracy (75%) compared to ULBT. These findings underscore the superior performance of ULBT in the preoperative assessment of difficult intubation cases, providing valuable insights for clinical decision-making.

4. Discussion

The study addresses a critical concern in anesthesia - the prediction of difficult airways during laryngoscopy and tracheal intubation, which can have severe consequences if not anticipated. The Upper Lip Bite Test (ULBT) and Thyromental Distance (TMD) were chosen for comparison, as they represent distinct methods for preoperative airway assessment. The ULBT, assessing temporomandibular joint movement, incorporates various factors, including weight, head and neck mobility, jaw movement, receding mandible, and buck teeth. This study suggests that the ULBT, particularly in cases involving jaw subluxation and buck teeth, is more effective in predicting difficult intubations. The categorization into three classes provides a nuanced evaluation of the airway, contributing to its reliability.

On the other hand, TMD measures the distance between the laryngeal prominence of the thyroid cartilage and the mental protuberance of the mandible. A TMD equal to or less than 6 cm is considered indicative of potential difficulty in intubation. While TMD has been a valuable metric, this study reveals a lower sensitivity and accuracy compared to ULBT. The results demonstrate that ULBT outperforms TMD in sensitivity, specificity, positive predictive value, and negative predictive value. The high sensitivity and negative predictive value of ULBT

indicate its effectiveness in ruling out difficult intubation cases, crucial for patient safety. TMD, although showing reasonable specificity, has limitations in accurately predicting difficult cases.

The timely identification of a challenging airway is crucial as unsuccessful intubation poses significant risks, leading to increased morbidity and mortality for the patient [4,5]. The ability to anticipate potentially difficult tracheal intubation allows anesthesiologists to implement precautionary measures and mitigate associated risks[6].

In 2003, Khan et al introduced the Upper Lip Bite Test (ULBT) as a straightforward method for predicting difficult intubations, utilizing temporomandibular joint movement as a representation. ULBT integrates factors like weight, head and neck mobility, jaw movement, receding mandible, and buck teeth, making it potentially more predictive for assessing difficult airways in individuals with jaw subluxation and buck teeth[7].

Additionally, thyromental distance (TMD) was measured in this study with values equal to or less than 6 cm considered predictive of difficult intubation when measured in the upright sitting position with the head in complete extension. The findings of this study indicated that the ULBT exhibited superior sensitivity, specificity, positive predictive value, and negative predictive value compared to thyromental distance in predicting difficult intubations, effectively averting potential morbidity and mortality associated with inaccurate predictions. These results align with a 2018 study by Elnaz Faramarzi, which also concluded that the Upper Lip Bite Test possesses moderate sensitivity and positive predictive value, along with high specificity and accuracy, making it a valuable bedside test for evaluating the airway in patients requiring general anesthesia[8].

These comparative findings show the importance of selecting the most appropriate preoperative assessment tool for airway management. While TMD has demonstrated utility in predicting difficult intubation, ULBT appears to offer a more comprehensive evaluation, especially in scenarios involving jaw subluxation and buck teeth. The limitations of the current study, such as the relatively small sample size and the exclusion of certain medical conditions, should be considered when interpreting the results. Future research could explore larger and more diverse patient populations to further validate and generalize the observed trends.

ULBT, assessing temporomandibular joint movement, proves valuable in cases where jaw mobility and

anatomy play a crucial role in airway management. It offers a comprehensive evaluation by considering factors such as weight, head and neck mobility, jaw movement, receding mandible, and buck teeth. In routine preoperative assessments, ULBT can be particularly useful for predicting difficult intubations in patients with unique anatomical features. Patients with jaw subluxation and buck teeth may benefit significantly from ULBT. The test's ability to categorize patients into three classes (I, II, and III) provides a nuanced understanding of the potential difficulty of intubation.[9] In scenarios where jaw anatomy is a primary concern, such as patients with limited jaw movement or pronounced buck teeth, ULBT may offer superior predictive value.

While ULBT excels in assessing jaw-related factors, Thyromental Distance (TMD) serves as a complementary measure focusing on the relationship between the thyroid cartilage and the mental protuberance of the mandible. TMD can be particularly relevant when assessing overall neck and head anatomy. In cases where the potential difficulty lies in the alignment of the thyroid cartilage and the mandible, TMD can provide additional insights. [10] TMD may be more suitable in scenarios where the patient's neck anatomy and alignment between the thyroid cartilage and mandible are critical factors. For example, patients with limited neck mobility or those with anatomical variations affecting the alignment may benefit from TMD assessment. TMD could be particularly relevant in predicting difficulty when jaw-related factors are less prominent.

In routine preoperative assessments, a holistic approach involving both ULBT and TMD can provide a comprehensive evaluation of potential intubation challenges. Combining these tests allows clinicians to consider both jaw-related factors and overall neck anatomy, enhancing the accuracy of difficult airway prediction. The choice between ULBT and TMD may also depend on patient-specific factors, such as the presence of conditions affecting the temporomandibular joint, previous airway difficulties, or known anatomical variations. Clinicians should tailor their approach based on individual patient characteristics to optimize the accuracy of the predictive assessment.[11,12]

Both ULBT and TMD can be integrated into routine preoperative protocols, providing a standardized approach to airway assessment. The tests can be conducted as part of the pre-anesthetic evaluation, allowing clinicians to identify potential difficulties early in the planning process and take appropriate precautions.[13] ULBT and TMD offer unique insights into different aspects of airway anatomy. The choice between the two tests should be guided by the specific clinical context, with ULBT being particularly advantageous in cases where jaw-related factors are prominent, and TMD serving as a valuable measure for assessing overall neck and head anatomy. The integration of both tests in routine preoperative assessments can enhance the accuracy of predicting difficult intubations and contribute to improved patient safety during anesthesia.[14,15]

5. Conclusion

This study systematically compared the Upper Lip Bite Test (ULBT) and Thyromental Distance (TMD) for predicting difficult intubation in a cohort of thirty patients undergoing elective procedures. The findings shed light on the distinct strengths and applications of each method in the context of preoperative airway assessment. The study demonstrated that ULBT, assessing temporomandibular joint movement and encompassing various anatomical factors, exhibited superior sensitivity, specificity, positive predictive value, and negative predictive value compared to TMD. Particularly noteworthy was the exceptional sensitivity of ULBT, making it a valuable tool for ruling out cases with difficult intubation. This suggests that ULBT, especially in patients with jaw subluxation and buck teeth, offers a more reliable predictive value for assessing difficult airways. Incorporating ULBT into routine preoperative assessments can contribute to enhanced patient safety, optimized resource utilization, and improved clinical outcomes. The study underscores the need for a nuanced approach, considering the unique strengths of each method and tailoring the choice of airway assessment tool to individual patient characteristics. Future research could further explore the comparative effectiveness of these methods in larger and more diverse patient populations, providing additional insights for refining airway management protocols in clinical practice. Overall, this study adds valuable knowledge to the field of anesthesiology, aiding clinicians in making informed decisions for preoperative airway assessments.

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