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Sublingual *vs.* intranasal dexmedetomidine sedation for flexible fiberoptic bronchoscopy procedure: a retrospective comparative study

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Abstract. – OBJECTIVE: Flexible fiberoptic bronchoscopy (FOB) is an often-employed invasive method in diagnosing, staging, and treating lung diseases. Conventional sedative agents facilitate this process. Dexmedetomidine (DM) has low side effects and is easy to administer for trans-mucosal absorption. This study aimed to investigate trans-mucosal DM used with local anesthesia during the FOB procedure.

PATIENTS AND METHODS: Fifty-nine cases were retrospectively analyzed who had undergone diagnostic flexible fiberoptic bronchoscopy (FOB) in our clinic between September 2016 and September 2019. The two methods (Group 1: Sublingual, and Group 2: Intranasal) employed during the FOB procedure for the local anesthesia were compared.

RESULTS: Fifty-nine patients were included in the study, wherein forty-six were males (77.9%), and thirteen (22.1%) females had a mean age of 58.02±8.7 years (range: 39-72 years). Thirty-three patients were in Group 1 (Sublingual) and 26 in Group 2 (Intranasal). No significant differences were there between groups regarding age, gender, body mass index, or ASA physical status. Modified Aldrete Score >9 was significant to reach with time as a correlation between operator and patient satisfaction. Sedation scores for groups at 1st, 9th, 12th, and 15th min were similar. Excessive coughing was observed in two (7.7%) patients of Group 2 but in none of Group 1 (p=0.105). Patients in both groups had no complaints of swallowing, excessive body movement, or lower oxygen saturation during examination (p>0.05). There were no complications (hypotension, bradycardia, respiratory depression, allergy, permanent amnesia, nausea, and vomiting) observed in patients.

CONCLUSIONS: Our study results revealed that easily administered trans-mucosal dexmedetomidine sedation is safely applied during flexible fiberoptic bronchoscopy for adequate sedation, high satisfaction, and low complication rates with no significant difference in sublingual or intranasal administration.

Key Words:
Dexmedetomidine, Bronchoscopy, Sedation, Sublingual, Intranasal.

Introduction

Flexible fiberoptic bronchoscopy (FOB) is an often-employed invasive method for diagnosing, staging, and treating lung diseases. Bronchoscopy was previously performed using local anesthesia only because of the sedation possibility of causing respiratory depression and disrupting hemodynamics. Cough, urge to swallow, inability to breathe, and pain occur frequently during FOB performed under local anesthesia only without additional sedation. Patients feel discomfort when only local anesthesia is applied, and complex procedures become difficult for both the patient and the physician. Applying FOB with sedation and local anesthesia is thus preferred for minimizing the said problems. Sedative agents may, however, cause issues. Anesthetic agents employed for sedation may bring respiratory depression, hypoxia, arrhythmia, and myocardial ischemia. FOB usage has increased in recent years. However, ideal sedative agents are still controversial[1,2].

The ideal sedative agent for FOB does not increase hypoxia, impair hemodynamics, or cause minimal tolerable changes. Dexmedetomidine (DM) is a specific alpha-2 receptor agonist in the imidazolines subgroup and is marketed as intensive care usage for continuous intravenous sedation. It acts on receptors in *locus ceruleus* and provides sedation and analgesia through receptors in the spinal cord without respiratory depression. It has limited adverse effects, such as hypotension and bradycardia. DM has a number of pharma-

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codynamic characteristics that make it useful in anesthesia, including decreased MAC (Minimum Alveolar Concentration), analgesia without respiratory depression, and reduction in catecholamine secretion. It is intravenously administered in routine. Trans-mucosal administration is, however, easier, convenient, and effective with high absorption. The sedative and analgesic effects of intravenously administered DM are studied in current literature, while studies[3-5] on alternative routes of DM administration are limited.

This study aimed to investigate trans-mucosal DM used with local anesthesia during the FOB procedure. Two groups (Group 1: Sublingual and Group 2: Intranasal) of trans-mucosal administration methods were compared regarding success rate, safety, and applicability. The study was designed on the hypothesis of having advantages such as easy applicability and fewer complications.

Patients and Methods

Fifty-nine cases who had undergone elective diagnostic FOB in our clinic between September 2016 and September 2019 were included in this retrospective analysis. 46 cases were males (77.9%) and 13 (22.1%) females with a mean age of 58.02±8.7 years (range: 39-72 years). The study was approved by the Ethical Committee (TÜTF/BAEK /2017-289), and informed consent was obtained from all patients.

The study was conducted in the Department of Thoracic Surgery at a tertiary care teaching institute. All patients undergoing diagnostic FOB *via* administering DM sedation were included in the study. Two experienced clinicians performed bronchoscopies. Age, gender, height, weight, body mass index, and American Society of Anesthesiologists (ASA) scores were monitored. 56 patients were divided into two groups: Group 1 (n = 33) with sublingual and Group 2 (n = 26) with intranasal sedation. Two groups were compared regarding pain level, sedation level, hemodynamic parameters, procedure tolerance, and complications. A case-control form having Addenbrooke sedation score during the procedure and modified Aldrete score in the recovery room was utilized (Table I).

Patients under 18 having comorbid diseases such as asthma, cardiac rhythm disorder, coronary artery disease, liver and kidney failure, hemodynamic instability, saturation below 90% despite oxygen support, DM allergy, and ASA physical status of 4 were excluded from this study.

Study Design

Both groups were administered 2% lidocaine inhalation i.v. 30 min before the procedure. Baseline vital signs were recorded for the patients before sedation. Nasal 2% lidocaine was used for local anesthesia at nasopharynx, oropharynx, and vocal cord levels. Afterward, DM was intranasally or sublingually administered as 1 µg/kg. No additional DM dose was given during the procedure. DM was administered by an insulin

Table I. Modified Aldrete Score.

Criteria	Characteristics	Points
Activity	Able to move 4 extremities	2
	Able to move 2 extremities	1
	Unable to move extremities	0
Respiration	Able to breathe deeply and cough freely	2
	Dyspnea or limited breathing	1
	Apneic	0
Circulation	BP +/- 20% of pre-anesthetic level	2
	BP +/- 20-49% of pre-anesthetic level	1
	BP +/- 50% of pre-anesthetic level	0
Consciousness	Fully awake 1	2
	Arousable on calling	1
	Not responding	0
Oxygen saturation	Able to maintain O_2 saturation >92% on room air	2
	Needs oxygen to maintain O_2 saturation >90%	1
	O_2 saturation <90% even with supplemental oxygen	0

BP: Blood pressure, O_2: Oxygen

syringe (1 mL) and dropped in the buccal or nasal mucosa. The patients were monitored. They were delivered with 2 L/min oxygen *via* nasal cannula and observed before, during, and after the procedure. They were recorded for adverse impacts (respiratory depression, hypotension, bradycardia, or arterial desaturation SPO_2 <92%). Abdominal wall and chest excursions were observed as alternative methods for monitoring ventilation. The pre-procedure sedation level was evaluated before the FOB by the Addenbrooke sedation score. The scale was constituted by 7 points: 1 = agitated, 2 = awake, 3 = roused by voice drowsy, 4 = roused by tracheal suction, 5 = unrousable, 6 = paralyzed, and 7 = asleep. A score ≥3 was accepted as a sedation level. A diagnostic FOB procedure was initiated, and no additional sedation was employed.

Patients were registered as per the case report form at the 1st, 3rd, 6th, 9th, 12th, and 15th min. Vital parameters were recorded during crossing through vocal cords. Once the bronchoscopy advanced into the trachea, the bronchoscopist administered a topical spray of 2% lidocaine (3 mL). The cough was prevented by secretion suction, and 2% lidocaine (2 mL) was readministered *via* a bronchoscope. The same dose was repeated if the cough persisted. Bronchoscopic procedures included examination only or with biopsy by forceps. Bronchoalveolar lavage (BAL) was routinely managed. After the procedure, the operator answered the satisfaction questionnaire on a 4-point scale (1: poor, 2: fair, 3: good, 4: excellent). The patient was taken to the recovery room for initial monitoring, and follow-up continued regarding sedation score, MAS, satisfaction status, and vital parameters. Any adversity was treated and recorded, such as bradycardia (heart rate ≤60 beats/min), hypotension (≥20% decrease in mean arterial pressure compared to baseline value), respiratory depression (respiratory rate ≤12 min), or oxygen desaturation (SPO_2 ≤92%) during the procedure. The FOB team was prepared for respiratory and cardiac resuscitation when necessary. Once the orientation was intact, patients answered a questionnaire about post-procedural events, such as nausea, vomiting, dizziness, recall, and pain. Patient satisfaction with the entire procedure on a 4-point scale (1: poor, 2: fair, 3: good, 4: excellent) was noted. Amnesia was recorded at 5, 10, 15, 30, 45, and 60 min after FOB. Patients were monitored for adverse effects during the 6 hours of the post-procedure period. They were sent to the ward if no complications arose and attained a modified Aldrete score >9.

Statistical Analysis

Statistical analysis was conducted using SPSS for Windows 15.0 (SPSS Inc., Chicago, IL, USA). The normal distribution of variables was analyzed by the Kolmogorov-Smirnov test. Categorical variables were compared through Chi-Square and Fisher's exact tests. Mann-Whitney-U and Kruskal-Wallis' tests were employed for non-normally distributed variables. Time-dependent changes in hemodynamic parameters were evaluated *via* repeated-measures analysis of variance test. The significance value was set at $p < 0.05$.

Results

59 patients were included in the study, wherein 46 were males, and 13 were females, with a mean age of 58.2±10.32 years (range 42-68 years). 33 patients were placed in Group 1 (Sublingual) and 26 in Group 2 (Intranasal). DM sedative was given to each group randomly for every assignment. Groups were formed independently, and randomly, with equal probability. There were no significant differences between the groups pertaining to age, gender, body mass index, or ASA physical status. Comparisons of baseline characteristics between the groups are summarized in Table II.

The repeated-measures analysis of variance results is given in Table III. Mauchly's sphericity test (SBP: df = 4, $\chi^2 = 53.80$, $p < 0.0001$; DBP: df = 4, $\chi^2 = 97.17$, $p < 0.0001$; MAP: df = 4, $\chi^2 = 77.07$, $p < 0.0001$; heart rate: df = 4, $\chi^2 = 85.95$, $p < 0.0001$; SpO_2: df = 4, $\chi^2 = 370.84$, $p < 0.0001$) did not confirm the presumption of covariance matrix sphericity. Huynh-Feldt test was thus employed.

Time-dependent correlations between weight, body mass index, total DM consumption, MAS at 5 and 10 min, patient satisfaction, and surgical satisfaction with sedation scores are presented in Table IV.

Groups were compared at the collected time points for SBP, heart rate, and SpO_2 values. Upon comparison of SBP values of groups, the correlations of the 1st, 3rd, 6th, and 9th min were not significant ($r = -0.248$; $p = 0.059$, $r = -0.033$; $p = 0.802$, $r = -0.239$, $p = 0.069$, $r = -0.154$; $p = 0.244$, respectively); however, the 12th and 15th min were significant ($r = -0.355$; $p = 0.007$, $r = -0.369$; $p = 0.005$, respectively) (Figure 1a). No statistically significant change was found while comparing the heart rate values ($r = 0.023$; p=0.863, $r = 0.142$; $p = 0.283$, $r = 0.032$, $p = 0.0811$, $r = -0.165$; $p = 0.211$, $r = -0.154$, $p = 0.253$, $r = -0.143$; $p =$

Table II. The comparison of baseline characteristics between groups.

	Group1 (n = 33)	Group 2 (n = 26)	p
Age, (year)	61.67 ± 11.23	56.96 ± 12.09	0.128
Height, (cm)	168.61 ± 6.71	167.73 ± 6.67	0.620
Weight, (kg)	70.64 ± 10.78	73.96 ± 14.93	0.325
Body mass index, (kg/m^2)	24.86 ± 3.65	26.29 ± 5.34	0.229
Gender, n (%)			
Female	6 (18.2)	7 (26.9)	0.421
Male	27 (81.8)	19 (73.1)	
ASA PS, n (%)			
ASA PS I	11 (33.3)	11 (42.3)	0.143
ASA PS II	18 (54.5)	8 (30.8)	
ASA PS III	4 (12.2)	7 (26.9)	

ASA PS: American society of anesthesiologist physical status score, Values are expressed as number (percentage), mean ± standard deviation, Independent-samples *t*-test, Chi-square test, $p < 0.05$, statistically significant.

0.289, respectively) (Figure 1b). Comparison of SpO_2 values revealed that (r = 0.047; p = 0.722, r = -0.177; p = 0.179, r = -0.134, p = 0.313, r = -0.067; p = 0.613, r = -0.241; p = 0.071, r = -0.103; p = 0.444, respectively) correlations at all times were not significant (Figure 1c).

Correlation between operator and patient satisfaction with time for attaining Modified Aldrete Score >9 was significant (r = -0.272, p = 0.037, r = -0.405, p = 0.001, respectively). The correlation between ASA PS and operator satisfaction was significant; however, it was insignificant with pa-

Table III. The results of repeated-measures ANOVA for comparison of the hemodynamic parameters between groups.

Parameters	Sources	Sum of Squares	df	Mean Squares	F	Effect Size	p
SBP (mmHg)	Sphericity Assumed	3808.83	5	761.77	2.63	0.046	0.024
	Greenhouse-Greisser	3808.83	3.71	1028.02	2.63	0.046	0.040*
	Huynh-Feldt	3808.83	4.08	933.97	2.63	0.046	0.035
	Lower bound	3808.83	1.00	3808.83	2.63	0.046	0.111
DBP (mmHg)	Sphericity Assumed	957.88	5	191.58	1.06	0.19	0.386
	Greenhouse-Greisser	957.88	3.26	294.13	1.06	0.19	0.373
	Huynh-Feldt	957.88	3.55	269.92	1.06	0.19	0.376
	Lower bound	957.88	1.00	957.88	1.06	0.19	0.309
MAP (mmHg)	Sphericity Assumed	1597.30	5	319.52	1.83	0.036	0.107
	Greenhouse-Greisser	1597.30	3.37	474.02	1.83	0.036	0.136
	Huynh-Feldt	1597.30	3.68	433.88	1.83	0.036	0.130
	Lower bound	1597.30	1.00	1597.62	1.83	0.036	0.182
Heart rate (bpm)	Sphericity Assumed	1891.14	5	378.23	2.90	0.050	0.014
	Greenhouse-Greisser	1891.14	3--02	627.13	2.90	0.050	0.036*
	Huynh-Feldt	1891.14	3--27	578.68	2.90	0.050	0.032
	Lower bound	1891.14	1.00	1891.14	2.90	0.050	0.094
SpO_2	Sphericity Assumed	199.09	5	39.82	1.23	0.022	0.296
	Greenhouse-Greisser	199.09	1.32	150.86	1.23	0.022	0.285
	Huynh-Feldt	199.09	1.36	145.95	1.23	0.022	0.286
	Lower bound	199.09	1.00	199.09	1.23	0.022	0.273

SBP: systolic blood pressure, DBP: diastolic blood pressure, MAP: mean arterial pressure, SpO_2: peripheral oxygen saturation, ANOVA, analysis of variance, Repeated-measures ANOVA, *$p < 0.05$, statistically significant.

Table IV. Time-dependent correlations between sedation scores with weight, body mass index, total dexmedetomidine consumption, MAS at 5 minutes, MAS at 10 minutes, patient satisfaction and operator satisfaction.

		1. min	3. min	6. min	9. min	12. min	15. min
Weight	r	0.315	0.358	0.365	0.317	0.237	0.234
	p	0.015*	0.005*	0.004*	0.014*	0.076	0.080
Body mass index	r	0.319	0.371	0.400	0.346	0.288	0.273
	p	0.014*	0.004*	0.002*	0.007*	0.030*	0.040*
Total dexmedetomidine consumption	r	0.264	0.337	0.346	0.286	0.203	0.200
	p	0.043*	0.009*	0.007*	0.028*	0.130	0.135
MAS at 5 minutes	r	0.038	0.152	0.173	0.179	0.323	0.319
	p	0.776	0.252	0.189	0.176	0.014*	0.015*
MAS at 10 minutes	r	-0.286	-0.326	-0.349	-0.392	-0.437	-0.427
	p	0.028*	0.012*	0.007*	0.002*	0.001*	0.001*
Patient satisfaction	r	-0.139	-0.159	-0.170	-0.191	-0.212	-0.208
	p	0.293	0.229	0.198	0.148	0.113	0.121
Operator satisfaction	r	0.165	0.285	0.311	0.388	0.318	0.315
	p	0.210	0.029*	0.016*	0.002*	0.016*	0.017*

r: Correlation coefficient, *$p < 0.05$, statistically significant.

tient satisfaction ($r = -0.267$, $p = 0.041$, $r = 0.147$, $p = 0.265$, respectively). There were no statistically different values upon comparing both groups for patients and operator satisfaction values ($p = 0.264$, $p = 0.125$, respectively).

Excessive cough was noted in 2 (7.7%) patients of Group 2 but in none of Group 1 ($p = 0.105$). Patients in both groups did not complain of swallowing, excessive body movement, or lower oxygen saturation during examination ($p>0.05$). No complications (hypotension, bradycardia, respiratory depression, allergy, permanent amnesia, nausea, and vomiting) were observed in any group when complication rates were evaluated.

Sedation scores of groups at 1st, 9th, 12th, and 15th min were similar ($p = 0.213$, $p = 0.639$, $p = 0.981$, $p = 0.900$, respectively). The 3rd and 6th min sedation scores of Group 2 were higher than those of Group 1 ($p = 0.007$, $p = 0.022$, respectively) (Figure 2). MAS values comparison of groups depicted no significant difference in 5th min MAS values ($p = 0.247$), and 10th min MAS values were lower in Group 2 ($p = 0.019$) (Table V). MAS 15th min values were not evaluated as they were >9 in both groups. No significant difference in amnesia was found during and after sedation ($p = 0.547$).

Discussion

This study compared sublingual *vs.* intranasal DM during the FOB procedure. Similar and sufficient sedation scores were achieved in the two groups. No statistical difference was obtained in both groups for patients and operator satisfaction values. There was no significant change when the groups' heart rate, SBP, and SPO_2 values were compared. Excessive cough was noted in 2 (7.7%) patients of Group 2 but in none of Group 1. Patients in both groups had no other complications or adverse effects.

The bronchial tree detail can be seen in fiberoptic bronchoscopy. Biophysical, cytopathological, bacteriological, and immunological information is obtained during the procedure. The nasopharynx, larynx, vocal cords, trachea, main bronchus, lobe, and segment bronchi are also examined.

In recent years, the usage of FOB practice and imaging methods has enhanced[6,7]. Patients undergoing FOB have symptoms of pain, cough, gagging, and choking sensation. Fear and anxiety developed before, during, and after the procedure represents another problem. Various sedatives are prescribed in addition to the standard premedication before the procedure. However, the sedation employed for the procedure is controversial. Some studies argue that sedation does not benefit FOB procedures and may lead to complications, such as respiratory depression and hypoxemia. However, sedation reduces stress and improves comfort and cooperation[8-12]. Agents providing effective sedation with less serious side effects, such as respiratory depression, are preferred. However, drug selection is controversial.

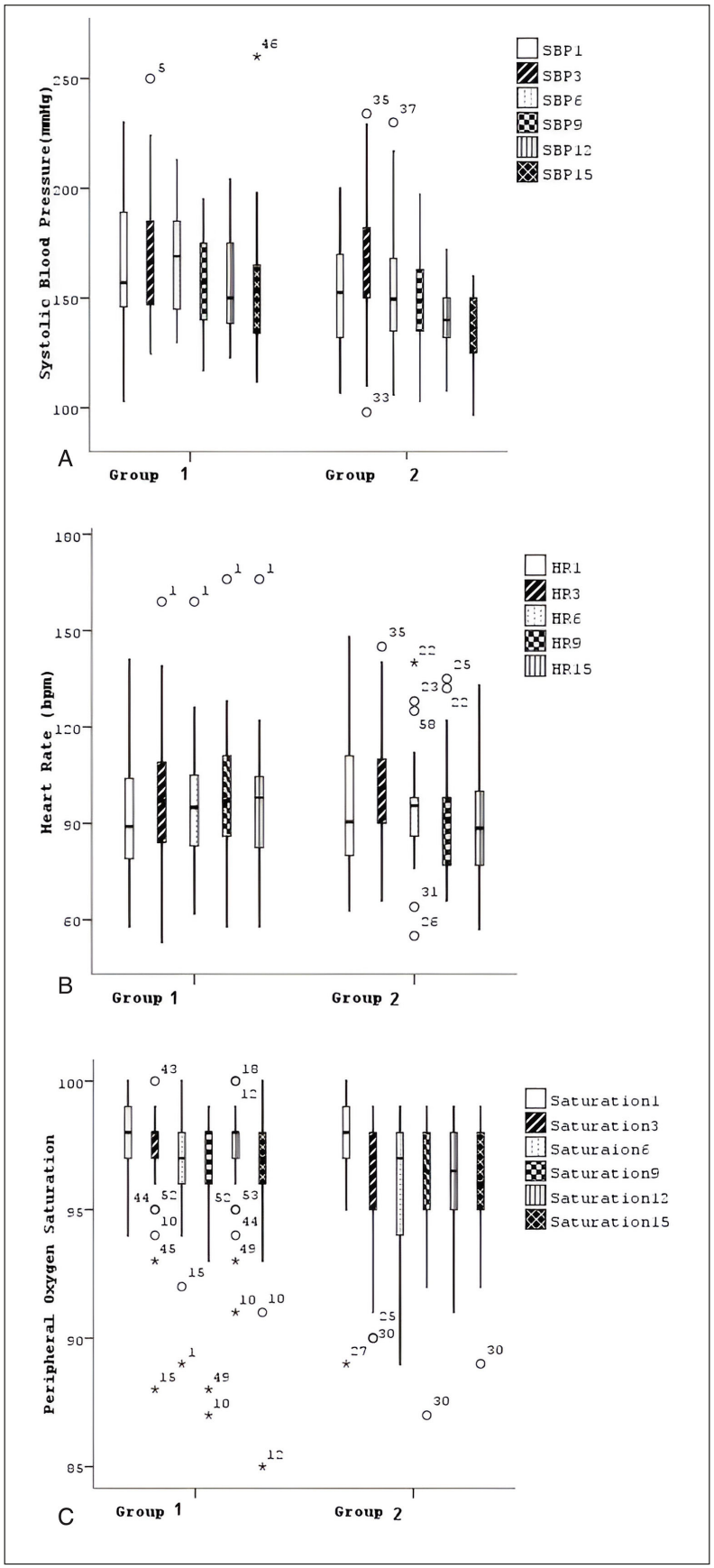

Figure 1. **A**, Time-dependent correlation between groups and systolic blood pressure. **B**, Time-dependent correlation between groups and heart rate. **C**, Time-dependent correlation between groups and peripheral oxygen saturation (SpO_2).

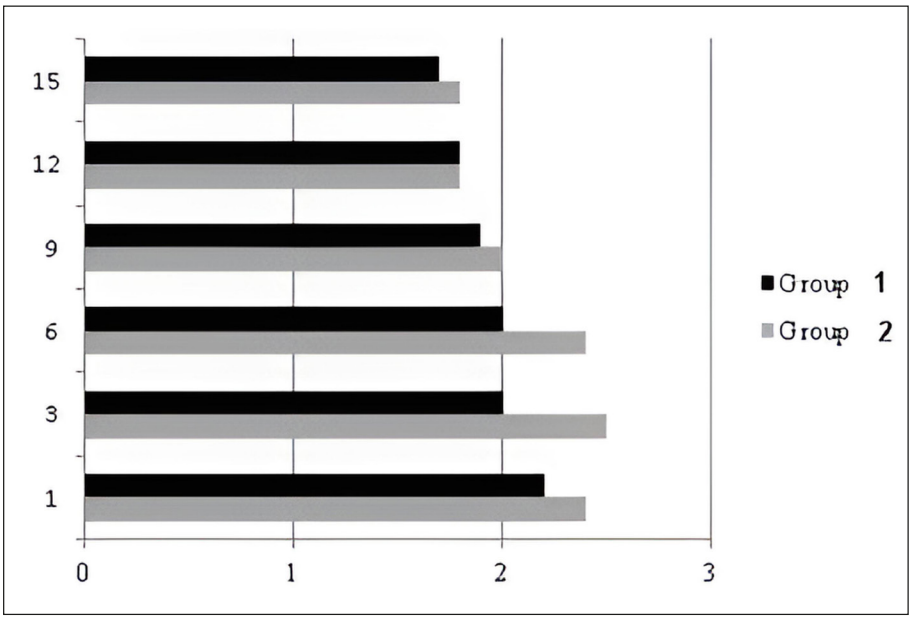

Figure 2. The comparison of Addenbrooke sedation scorebetween two groups.

Table V. The comparison of mean arterial pressure and heart rate during vocal cord crossing, total procedure and sedation time, total dexmedetomidine consumptions, and Modified Aldrete Scoring.

	Group 1 (n = 33)	Group 2 (n = 26)	*p*
MAP during vocal cord crossing, (mmHg)	116.33 ± 18.52	114.31 ± 18.20	0.676
Heart rate during vocal cord crossing, (bpm)	97.00 ± 22.71	99.38 ± 17.73	0.662
Total procedure time, (min)	10.00 ± 3.54	10.62 ± 3.77	0.522
Total sedation time, (min)	15.91 ± 2.32	15.00 ± 2.00	0.119
Total consumption, (μg)	7.11 ± 1.12	7.44 ± 1.51	0.330
MAS 5. minutes	9.06 ± 0.24	9.15 ± 0.37	0.247
MAS 10. minutes	10 ± 00	9 85 ± 3.68	0.019*
MAS > 9 time, (min)	8.79 ± 3.92	7.31 ± 3.74	0.147
Amnesia	1.30 ± 0.47	1.38 ± 0.70	0.593
Tolerance	1.76 ± 1.48	2.62 ± 2.23	0.082

MAP: mean arterial pressure, MAS: Modified Aldrete Score, Values are expressed as mean ± standard deviation, Independent-samples *t*-test, $p < 0.05$, *statistically significant.

Studies with i.v. DM sedation during FOB and comparison with other sedatives are available in the literature. It is reported[5,13,14] that DM is effectively and safely used as sublingual, especially in pediatric patients' premedication. DM may cause bradycardia and cardiac arrest as an intravenous bolus and uncontrolled infusion[5,13,14]. The bioavailability of sublingual DM is high (82%) for its potential role in pediatric patients[15]. According to the previous literature, the patients sedated with trans-mucosal DM during FOB were separated into two groups (Group 1: Sublingual, and Group 2: Intranasal). The success rate, safety, and applicability of two trans-mucosal methods were evaluated as per their previous usage in various groups and were reported as successful.

Goneppanavar et al[16] reported that DM assured better patient comfort and tolerance than midazolam in their randomized controlled trials. Shoukry[17] evaluated DM's clinical efficacy and safety and compared it with a propofol-fentanyl combination for sedation during FOB. It was concluded that both sedation methods were effective. However, DM was safer because of sympatholytic and respiratory stability. The present study compared intranasal and sublingual administration of the same

sedative, i.e., DM. There were no significant differences between groups regarding age, gender, body mass index, or ASA physical status. It is the first study in the literature to use trans-mucosal DM in sedation for patients undergoing FOB.

Andrade and Sarmiento[18], in their uncontrolled, double-blind, and prospective clinical trial, used sublingual and intranasal DM to sedate 68 cases for gynecological procedures. They reported sublingual being superior to intranasal because of lower additional sedatives dose and fewer changes in mean blood pressure. The trans-mucosal route was easily manageable with no complications. Shaat et al[19], in a randomized controlled clinical trial, compared intranasal and sublingual DM sedation for pediatric dentistry. No significant difference was found in the anxiety scores of the two groups. They concluded that both routes equally decreased the anxiety scores with no complications. Similar to the literature, the SBP values of groups in our study were compared, and correlations of 1st, 3rd, 6th, and 9th min were not significant. There was no significant change in the comparison of heart rate values. No complications were observed (hypotension, bradycardia, respiratory depression, allergy, permanent amnesia, nausea, and vomiting) in any group.

Garip et al[20] reported that intranasal DM administration for ambulatory dental surgery was an effective, safe, and suitable alternative to general anesthesia. They concluded that intranasal DM patients were more satisfied than general anesthesia patients. In a recent meta-analysis[21], the authors found no statistically significant difference between patients' satisfaction during FOB. Heterogeneity was also high among the included studies[21]. In our study, the correlation between operator and patient satisfaction with time for attaining Modified Aldrete Score >9 was significant. The correlation between ASA PS and operator satisfaction was significant. However, it was insignificant for patient satisfaction. Moreover, there were no statistically different values in the comparison of both groups for patients and operator satisfaction values.

DM can be administered intravenously, intramuscularly, and trans-mucosally (through rectal, intranasal, or sublingual routes). The trans-mucosal route has rapid onset and bypasses first-pass metabolism, unlike intramuscular or intravenous. It can be applied non-invasively without the need for needles. Trans-mucosal DM dose requires safe and adequate analgesia with a sedation dose of 1-2 μg/kg. Drugs in high doses may lead to hemodynamic changes. Sublingual provides longer and safer sedation time than intranasal route[19-21]. A single sublingual DM dose of 180 μg or 120 μg may reduce agitation severity[21]. In our study, 1 μg/kg DM was used in an intranasal or sublingual way to achieve safe and adequate sedation for the FOB procedure.

In a systematic review and meta-analysis[22] published in recent years, it is reported that inhaled nebulized DM can be employed for sedative purposes in children. Inhaled nebulized DM, compared to other sedatives, provides equal sedation satisfaction reduces agitation and, postoperative nausea, and vomiting[22]. Inhaled nebulized DM as an alternative to the trans-mucosal route can be used for sedation during the FOB procedure in the future.

Also, in another study by Zhang et al[23] conducted in recent years, remimazolam besylate combined with alfentanil can be used alternatively for sedation during the FOB procedure. According to the study, spontaneous breathing of patients is less affected, and respiratory depression is less common with this sedation technique[23].

Study Limitations

The study's important limitation can be its retrospective nature. Furthermore, these findings are from a single institution and a small case sample. The findings cannot thus be generalized to all the patients undergoing FOB via trans-mucosal DM sedation. A control group is required with different sedatives than in our study. Despite these limitations, the current study provides information about the safe, satisfactory, and successful use of DM sedation during FOB by two trans-mucosal routes. Another positive aspect pertains to the inclusion of this issue in the literature for further discussions and studies.

Conclusions

Our study outcomes revealed that during fiberoptic bronchoscopy, easily administrable trans-mucosal dexmedetomidine sedation is safely applied. The sublingual and intranasal groups had similar characteristics in terms of achieving adequate sedation levels, high patient and operator satisfaction, and low complication rates. The sedation technique can be widely practiced in the future for this procedure. The randomized controlled trials with larger case series are, however, required.

Conflicts of Interest
None.

Authors' Contributions
All authors substantially contributed toward conception, design, acquisition, analysis, and data interpretation.

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Ethics Approval
This study was approved by the Ethics Committee of the Trakya Univesity School of Medicine, Edirne, Turkey (TÜTF/ BAEK /2017-289).

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Data Availability
The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Informed Consent
Written informed consent was obtained from all participants.

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