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EUROPEAN POSITION PAPER ON DRUG-INDUCED SLEEP ENDOSCOPY (DISE): 2017 UPDATE

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EUROPEAN POSITION PAPER ON DRUG-INDUCED SLEEP ENDOSCOPY (DISE): 2017 UPDATE

INTRODUCTION

The first edition of the European position paper on drug-induced sleep endoscopy (DISE) was published in 2014 with the aim to standardize the procedure, to provide an in-depth insight into the main aspects of this technique and to have a basis for future research. To achieve these endpoints, European specialists in ENT, anesthesia and pulmonology among various departments in leading European centers, have evaluated all the available evidence reported in the literature and have compared their experience on DISE [**1**].

Since 2014, new studies have been published concerning new sedative agents or new insights in the pattern/levels of the obstruction depending on the depth of sedation. Therefore, the authors have decided to publish an update of the European position paper on DISE, in order to include new evidence and to find a common language useful for reporting the findings of this endoscopic evaluation in patients with sleep breathing disorders (SBD).

The current position paper and all the literature reported focused on the adult population affected by SBD. The DISE standardization in SDB pediatric population may be the issue of a specific position paper, considering its strictly related diagnostic and therapeutic characteristics.

ETHICAL CONSIDERATIONS

The current position paper was designed and conducted in compliance with the principles of Good Clincal Practice regulations and the Helsinki declaration.

TERMINOLOGY

This procedure was first introduced as sleep nasendoscopy, abbreviated SNE [**2**]. Various other names that have been used are sleep endoscopy [**3**, **4]**, video sleep nasendoscopy [**5**], drug-induced sleep endoscopy [**6, 7**] and fiber-optic sleep endoscopy [**8**]. In the first edition of this paper we proposed the term Drug-Induced Sedation Endoscopy (DISE), to highlight the use of sedation during the study, but the authors have decided to adopt the term Drug-Induced Sleep Endoscopy (DISE), since the former could be considered a pleonasm and since the latter is more accepted and commonly used in the literature. If the procedure is performed during natural sleep, the work group suggests using the definition of Natural Sleep Endoscopy (NSE).

INDICATIONS

As DISE provides additional information about upper airway (UA) site(s) and pattern(s) of narrowing and obstruction in Obstructive Sleep Apnoea (OSA) and snoring, it should be performed in selected patients in whom this additional information concerning the dynamics of the UA is considered to be of added value. Therefore, DISE can be performed when positive airway pressure (PAP) alternatives, such as upper airway surgery (UAS), oral appliance therapy (OAT) therapy, positional therapy (PT) or a combination of different treatment modalities are considered [**9**]. Studies suggest that DISE in comparison to awake evaluations alters surgical treatment plans in approximately 50% of OSA patients **[10]**. Nevertheless, this gives no indication concerning the impact of DISE on surgical outcomes, which has been investigated in a few retrospective studies. It has been demonstrated that specific findings during DISE are associated with worse or better outcomes after certain procedures. Interpretation of PSG, UA examination and DISE findings combined direct surgical treatment plans and assist in predicting surgical outcomes [**11-14**].

Besides being employed to evaluate treatment alternatives to CPAP, DISE can also be applied to improve understanding of the anatomical basis for surgical, MAD, or PAP (positive airway pressure) failure, incomplete

response or intolerance. DISE can be performed with and without simultaneous OAT and PAP application, providing insights to identify the residual anatomical locations of UA collapse, directing additional medical and surgical treatment options to augment the clinical effectiveness of current conservative therapy or identify viable alternatives **[15, 16].** In case of non-responders to surgery DISE provides insights to the remaining causes of UA collapse, guiding further surgical and non-surgical treatment options [**17,18**].

GENERAL CONTRAINDICATIONS

The safety of DISE is of paramount importance. DISE should be performed in patients with acceptable overall anesthetic risk profile. Absolute contraindications are ASA 4 and pregnancy, and allergy to DISE sedative agents. Relative contraindications may include morbid obesity, considering that morbid obese patients usually are not good candidates for UA surgery or OAT. Otherwise, morbid obesity does not represent an absolute exclusion criterion for DISE when the patient has specific correctable UA anatomical features, which endorse careful consideration of surgical treatment options or an OAT.

REQUIRED PRELIMINARY EXAMINATIONS AND PATIENT'S SELECTION

The Working Group recommends certain prerequisites prior to considering DISE [**19, 20**]. A type 1, 2, or 3 sleep study according to American Academy of Sleep Medicine (AASM) is pivotal in the work-up to assess severity of OSA, position dependency and differentiate between obstructive or central events. Although DISE is a diagnostic tool, the ENT specialist performing DISE must always keep in mind that DISE is a snapshot of the patient's UA obstruction and cannot replace a full night sleep study, since one cannot assess the type and severity of the sleep breathing disorder through DISE. Clinical and endoscopic awake UA examination is also essential as some characteristics of the patient are better observed while awake. According to the local departmental guidelines, other kinds of clinical assessment may be necessary (blood test, visit to anesthetist).

WHERE TO PERFORM DISE

DISE can be performed in any safe clinical setting such as the operating theatre or endoscopy room or a similar clinical room set up with standard anaesthetic equipment (basic monitoring and resuscitation kits in case of emergency), and where relevant ambience such as silence and darkness is available. DISE can usually be performed as a day-case while, in some cases, overnight stay may be necessary depending on the patient's general condition and if surgical therapy has been concurrently performed.

TECHNICAL EQUIPMENT

The following essential setting is required: standard anaesthesiological monitoring [oxygen saturation (SatO2), electrocardiogram (ECG), blood pressure (BP)] and flexible endoscope. Other useful facilities are an infusion pump or, more preferably, target-controlled infusion (TCI) as the drug delivery system if the drug to be used is propofol and electroencephalogram (EEG)-derived indices. The latter are available to assess the depth of sedation and anesthesia, e.g. bispectral (BIS) index or cerebral state index (CSI), as well as polygraphic realtime monitoring. [**21-30**]. Although not mandatory, recording media (with or without audio) and playback equipment is desirable. DISE video footage can be used for educational and research purposes, intercollegiate consultation or used to inform the patient of test results.

In case DISE is being performed to evaluate OAT or CPAP failure, incomplete response or intolerance, the devices should be present.

STAFFING

The following essential setting is required (Adult Sedation Guidelines, NHS, 2010) [**31**]: 1) the clinician(s) who performs the endoscopic procedure. 2) an individual, whose sole responsibility is to monitor the patients and to observe their response to the medication and the procedure. This could be

an anesthesiologist or an appropriately clinically trained individual. 3) basic and advanced maneuvers (closure of the mouth, pull up, head rotation, etc.) performed during DISE could be carried out by a third person.

LOCAL ANESTHESIA, NASAL DECONGESTION, OTHER MEDICATIONS

In the literature, nasal decongestion, nasal local anesthesia, and anti-secretory drugs are described as preparatory measures and may be used as an option [**32–36**]. These preparatory measures can potentially interact with UA and breathing control and therefore have to be used with caution. UA suction would assist in obtaining a better UA assessment during DISE, if UA hypersalivation occurs. Performing DISE by means of an endoscope with a working channel could be useful in these patients, improving the UA assessment and the timing examination. We do not suggest an atropine infusion, because it could change the sleep physiology. Theoretically the use of atropine-like drugs could be useful in patients who have excessive secretions that may interfere with the view attained. However, the Working Group felt that due to the lack of knowledge on the impact of these drugs on sleep physiology and the changes it may create on the cardiovascular system this would be inappropriate. Similarly, the Working Group agreed that although the use of local anesthesia or decongestants may increase the ease of scope insertion and possibly reduce the incidence of nasal irritation, these drugs could interfere with the nasal resistance and therefore the airflow [**36**]. Thus, the dynamics of the upper airway would be made somewhat different to what actually occurs during natural physiological sleep.

PATIENT POSITIONING, BASIC AND SPECIAL DIAGNOSTIC MANEUVER

Ideally the patient is positioned in a fashion mimicking sleeping habits at home, e.g. 1 or two pillows, with or without dentures. The procedure is commonly performed in the supine position, even though patients may indicate to seldom sleep in the supine position.

In positional patients, in particular, performing DISE in both the lateral and supine position can be of added value. Especially since the role of positional therapy is gaining momentum [**37**], both as a single treatment option, or as combination therapy e.g. with OAT [**38**] or upper airway surgery [**39**]. Various studies have shown that DISE findings in these patients differ when performed in the supine or lateral position [**40, 41**]. In addition, Safiruddin et al. evaluated DISE results in lateral head and trunk position compared to only lateral head rotation. Both maneuvers showed almost similar results, which suggest that sometimes the upper airway in lateral position can also be evaluated by only rotating the head [**41, 42**]. Further studies are needed to confirm if lateral head rotation only results in the same effects as lateral head and trunk rotation.

Another diagnostic tool on top of standard DISE is the trans-oral fiberoptic endoscopic UA assessment. Trans-oral fiberoptic endoscopy could give additional information in selected patients if the mouth is open. In particular, the degree of tongue retraction and position could be evaluated both from the oral cavity as well as from the nasopharynx, highlighting a secondary antero-posterior soft palate collapse, due to the tongue position.

If treatment with OAT is considered, during DISE, it is recommended to mimic both the mandibular advancement and the vertical mouth opening in a standard and reproducible fashion, closely related to the OA characteristics, which might be constructed for the patient [**43, 44**]. There is evidence that a hyperprotrusion/maximal protrusion of the mandible has no predictive value towards the OAT outcome [**45**]. Therefore, performing a maximal mandibular protrusion maneuver is not advisable. If the patient's OAT is available during the DISE procedure, the Working Group recommends starting the sedation process with the OAT in situ and after the assessment of the UA with the OAT, to remove it and reassess in order to avoid arousals. This would inform the clinician on the efficacy of the OAT and would also allow determining if further advancement of the OAT is necessary or not. It should be taken into account that during DISE, an increase in vertical opening will increase the collapsibility of the UA at

the level of the tongue base in a large majority of patients. Finally, if available, the Working Group recommends the use of a simulation bite in maximal comfortable protrusion (MCP) of the mandible during DISE in patients with OSA, which could be effective in predicting treatment response of OAT [**45**].

DRUGS

There is a great variability on the drug or combination of drugs used for DISE reported in the literature. Basically, midazolam and propofol are the two drugs most widely used [**46**]. Midazolam and propofol are used as single agents or together for sedation. Some authors also combine them with other drugs such as remifentanil or ketamine. Another drug used for sedation is Dexmedetomidine, an alpha 2 adrenergic drug that produces sedation plus analgesia by inhibiting the locus ceruleus. Dexmedetomidine is characterized by a slightly longer onset of action (5-10 minutes), and patients take longer time to wake, some patients may not fall asleep at all. Nevertheless, explaining the mechanism of action of these drugs is beyond the scope of this article. The working group recommends reading the articles published Shteamer et al. and by Ehsan et al. for a deeper comprehension of the effects of these drugs on the brain and the UA [**46, 47**].

Most of the evidence that compares natural sleep and sedation is performed with propofol or midazolam as a single agent for sedation. Therefore, these are the drugs that should be used for DISE, as they provide a state that mimics the critical closing pressure during natural sleep without significant differences in the AHI [**46-48**]. The addition of remifentanil to propofol increases the desaturation of the patient, therefore it is not advisable despite its potential to reduce sneezing [**49**].

The dosage and management of Propofol and Midazolam are described in the following paragraph.

In **table 1** the advantages and disadvantages of the use of propofol, midazolam, and a combination of propofol and midazolam are described.

Suggestions for drug dosage (**Table 2**):

1. Propofol:

The working group recommends the use of a syringe infusion pump with target-controlled infusion (TCI) technology as the standard mode for sedation if propofol is the drug chosen for sedation, as it provides sedation that is more stable and reliable than manual infusion schemes or bolus technique [**50, 51**]. If a TCI infusion pump is not available, then a syringe infusion pump for manually controlled infusion is better than bolus. Most of the patients achieve the adequate sedation level at an effective site concentration of 3.2μg/ml [**51**]. Therefore, a starting dose of 3μg/ml could be applied, instead of the more conservative 2.0 or 2.5μg/ml, in order to achieve a quicker sedation. However, the physician must always consider that if the sedation is achieved too quickly, a more consistent number of central apneas can occur at the beginning, creating a false image of obstruction. We describe the 3 possibilities for performing DISE by Propofol:

a. TCI

Basic mode. Starting dose: 2.0 or 2.5μg/ml (effective site concentration). As some patients may not fall sleep with this starting dose, an increasing dose of 0.2–0.5 μg/ml every 2 minutes is suggested until the patient starts to snore and vibration and collapse of the UA is observed (variations are possible according to team experience).

b. Manually controlled infusion

Delivering dose: 50-100 ml/h depending on the patient response.

c. Bolus technique (variations are possible according to team experience) Proposal 1, starting dose: 30–50 mg, increasing rate of 10 mg every 2min. Proposal 2, starting dose: 1 mg/kg, increasing rate of 20 mg every 2 min.

2. Midazolam:

a. Bolus technique (variations are possible according to team experience). Starting dose: 0.05 mg/kg, observing for 2–5 min, increasing rate of 0.03 mg/kg only if patient is awake, then waiting for 5 min. If the patient is not completely asleep, further increase of rate if needed to 0.015 mg/kg.

b. Controlled infusion. No shared experiences and evidences in literature.

3. **Combination of Propofol + Midazolam** (variations are possible according to team experience)

When these two drugs are combined, the sedation is quicker. Nevertheless, the patient sneezes more frequently than with propofol alone, making the exploration more difficult [**52**].

Midazolam is used in first place using a single bolus starting dose of 0.05 mg/kg. After 2 minutes, the sedation proceeds with Propofol performed by TCI (effective site concentration), with a starting dose of 1.5–3.0μg/ml. If required, increasing rate 0.2–0.5 μg/ml every 2 minutes is suggested until a stable sedation is achieved.

OBSERVATION WINDOW

The Working Group suggests observing during a stable sedation level and consistent breathing pattern. This ideal observation window would typically last at least two cycles or one minute but it may take longer both for each segment of UA and during the maneuvers. We define cycle as a complete and stable sequence of snoring–obstructing hypopnea/apnea–oxygen desaturation–breathing with good observation of levels. Depending on the sedative agents used, it may be prudent to start the assessment of the procedure after the first cycle of snoring and obstruction has been

completed. This is particularly the case if the combination of midazolam and propofol is used to avoid a possible exaggerated early response and cause central apneas. Furthermore, central apneas can be observed at the beginning of sedation if propofol is injected too fast, therefore more cycles may be required if the bolus technique is used.

The working group recommends monitoring the level of sedation during the procedure using a clinical score such as the Ramsay Score, EEG derived indices such as bispectral index (BIS), cerebral state index (CSI), entropy, or sleep recording. If BIS is available, it should be between 80 - 60 during the procedure, obtaining a medium-sedation level status, consisting of loss of consciousness, defined as loss of response to verbal stimulation at a normal volume, comparable to a modified Ramsay sedation score of 5 [**53, 54]**. Although some studies have shown that the collapsibility of the UA increases with the depth of the sedation [**27, 53, 55, 56]**, according to Heiser et al. decision making does not change significantly if the sedation is lower than 60. Although lower levels of BIS have been related to N3 sleep phase, they could cause deep oxygen desaturation, significantly unsafe for the patient [**3, 29, 53, 54, 57**]. BIS values may not be the same if dexmedetomidine is the drug of choice, moreover there is variability amongst the patients in the level of sedation with the same BIS score. Therefore, the BIS range values of 80-60 is suggested just as a general rule and it might not be optimal for every SBD patient. However, further research is needed on the validation of using EEG derived indices during DISE, as well as with polygraphic real-time monitoring [**30, 54**].

LIST AND DEFINITIONS OF THE TARGET EVENTS

SNORING: Pharyngeal and/or laryngeal vibration, without obstruction

APNOEA / HYPOPNOEA: Pharyngeal and/or laryngeal complete or partial obstruction

COLLAPSE PATTERNS: anteroposterior or circumferential soft palate collapse, pharyngeal lateral wall collapse, tongue base collapse, epiglottic

trapdoor phenomenon, secondary epiglottic collapse, involvement of ary-epiglottic folds (**Figs. 1, 2a-b, 3a-b, 4a-b,5a-b, and 6a-b**).

SCORING AND CLASSIFICATION SYSTEMS

Several DISE scoring and classification systems are reported in the literature (**Table 3**) [**35, 40, 57–74**]**.**

The existence of so many classifications is a representation of the complex anatomy of the UA. We would like to make some comments on the anatomic areas. Soft palate, uvula and the corresponding lateral and posterior pharyngeal walls define the velopharynx area. Moreover, according to the TNM classification [**75**], hypopharynx has its superior limit at the level of the hyoid bone, where it is contiguous with the oropharynx. The major subsites of the hypopharynx are the pyriform sinuses, the post-cricoid region, and the pharyngeal wall. Therefore, this region is not involved in the collapse. All the important structures are located within the oropharynx. This region begins where the oral cavity ends at the junction of the hard and soft palates superiorly and the circumvallate papillae inferiorly and extends from the level of the soft palate superiorly, which separates it from the nasopharynx, and to the level of the hyoid bone inferiorly. The subsites of the oropharynx are the tonsil, base of tongue, soft palate, and pharyngeal walls. We could divide the oropharynx in two parts: the upper and lower oropharynx. The upper oropharynx includes the tonsils, lateral wall, posterior wall and soft palate. The upper border is the soft palate at the axial level defined by the hard palate in direction towards the posterior pharyngeal wall. The lower border is the caudal pole of the tonsils if present. Usually, a certain distance is left to reach the pyriform sinus. The space between the caudal pole of the tonsils and entrance of the piriform sinus could be classified as lower oropharynx. To make it more complex: the tongue base covers the upper and lower oropharynx. In general, the tonsils are located more caudal to the terminal sulcus of the tongue. Therefore, this part of the tongue base belongs to the upper oropharynx. The valleculae are usually located below the caudal pole of the tonsils and would belong to the caudal oropharynx.

As the tongue base overlaps with the palate in the upper part, some palatal collapses are caused by the tongue base, this has been shown in dynamic MRI studies [**76**].

The Working Group reached consensus on the fact that a scoring and classification system should include the following features: level (and/or structure), degree (severity), and configuration (pattern, direction) of obstruction.

Levels vs. structures

There was agreement on the fact that assessment of the nose and nasopharynx do not have the highest priority during DISE in adult population. In the first place, the role of the nose and nasopharynx is not as important as previously thought. Secondly, the situation in the nose and nasopharynx does not differ during awake and sleep stages. Regarding the number of levels, some presently used systems identify four levels of obstruction, others distinguish five. Some systems use levels, others prefer structures, others, for pragmatic reasons, use a hybrid system, including both levels and structures. Unfortunately, consensus on four or five levels/structures and on levels vs. structures has not been obtained. Some see oropharyngeal wall and tonsil as one level, others try to distinguish between oropharynx and tonsils.

Severity

Some systems have only 3 degrees of severity (none, partial, and complete obstruction), whereas other systems use a semiquantitative system with 0–25, 25–50, 50–75, and 75–100 % of obstruction.

The simplicity of the VOTE [Velum (palate), Oropharyngeal lateral walls, Tongue and Epiglottis] classification system [**65**] is a deliberate compromise to (over) comprehensiveness. Of all possible ideal features of such a system, during development of the VOTE system, good inter-rater

agreement was considered of higher importance than including all possible and rare forms of obstruction thinkable in a semiquantitative fashion, at the expense of reliability, reproducibility and inter-rater agreement. Others prefer the semiquantitative way; and again, consensus has not been obtained.

Configuration

There was agreement on the three forms of obstruction: anteroposterior, lateral, and concentric.

During the discussion, the following list of information was considered: severity of event, open airway segment, sound generation (snoring or stridor without impression of increased upper airway resistance), partial obstruction/ collapse (airway lumen cross-sectional area reduced with impression of increased upper airway resistance), complete obstruction/collapse (no airway lumen can be seen), site of event, palate (cranial of upper tonsillar pole), tonsil region (upper to lower tonsillar pole), tongue base (lower tonsillar pole to base of vallecula), larynx (supraglottis and glottis), and pattern of event (anteroposterior, lateral, and circumferential).

The Working group decided to adopt VOTE classification as essential with the possibility of adding comments (e.g. anatomical structures involved in the obstruction) for each level, as showed in the attached standard report of DISE (**Appendix 1**), in order to have a common starting dataset and results.

In order to score the obstruction, it is important to check the localization of the tip of the endoscope: (1) at the level of the choanae to assess the soft palate (i.e., velum), (2) at the level of the margin of the soft palate to assess the oropharynx, and (3) just above the level of the tongue base to assess the tongue base and the epiglottis.

OTHER TECHNIQUES FOR UA ASSESSMENT

UA evaluation is considered to be vital in order to attain site specific treatment and thus better surgical and nonsurgical treatment outcomes [**77**]. Numerous techniques to evaluate and assess the upper airway exist and include imaging, acoustic analysis, pressure manometry and DISE. Numerous disadvantages have been outlined such as radiation with some imaging techniques, cost issues, and lack of standardization with acoustic analysis software. Similarly, with DISE, doubts have been raised about various aspects but most of these have been addressed by various studies. Issues of inter-rater variation, test–retest reliability, and depth of sedation are a few examples [48, 34, 35, 58, **77**]. In addition, recent results indicate that both inter- and intraobserver agreement will be higher in ENT surgeons that have experience in performing DISE and that consequently proper training of ENT surgeons that start with DISE is necessary in order to obtain reliable observations [**78-79**]. The ideal evaluation of UA should include a three-dimensional assessment and representation during sleep as well as in the awake state. We believe that DISE provides a three-dimensional visualization of what actually happens during sleep, albeit during sedation. We strongly advocate the use of DISE and this European Position Paper provides a collective view on various aspects of the technique used by various European centers regularly dealing with management of patients with sleep related breathing disorders. To date, we believe that DISE provides the most useful information of upper airway collapse during sleep compared to other evaluation techniques available.

RECOMMENDED REPORT FORMAT

After any DISE procedure, the patient should have a report explaining the procedure and the findings of the UA assessment. In that report, we recommend to clearly report the drug/drugs used for the sedation, as well as the dosage achieved and if there were some other drugs different from the sedative one used (as decongestant, anti-secretory drugs or others). It is also mandatory to report the sedation level reached as assessed by EEG derived signal (BIS, CSI, or others) if used, and, finally, the modification of the UA obstruction pattern, in lateral and supine position, following head rotation and/or mandibular maneuvers have been performed. In order to

compare UA DISE assessment between the patients and the different operators, it is of upmost importance to adopt and report a DISE classification score system (**Appendix 1**).

FUTURE RESEARCH AGENDA

Some areas for future research can be defined:

- To come to one universally accepted scoring and classification system for DISE. Consensus should be reached on levels vs. structures and number (four of five) of levels/structures, severity (none/partial/complete vs. semi-quantitative assessment), and configuration of obstruction, in order to make this effort easier an essential agreement on VOTE as basic classification has been reached.
- To compare results and predictive power in non-PAP therapies of DISE with the use of standard VOTE classification.
- To implement and modify VOTE classification with new suggestions after its use in the next years.
- To promote a worldwide open dataset on DISE videos in order to compare different endoscopic patterns and findings, evaluated by means of a universally accepted DISE classification system.
- To assess in more detail whether certain DISE findings are related to treatment outcome and treatment advices.
- To assess the role of DISE for titration of titratable OSA therapies such as upper airway stimulation therapy or OA therapy.
- To better understand the impact of the use of the sedative drugs and their influence on UA collapse levels and patterns, as well as their influence on sleep patterns and stages.
- To improve the options for the measurement of the depth of sedation during DISE; different EEG-derived indices available should be evaluated and compared.

- To further compare the differences in degree, level, and pattern of UA collapse observed during DISE versus during natural sleep and awake endoscopy.
- To further explore the potential of DISE for the optimization of OSA treatment, providing new insight in non-anatomical SDB pathophysiological factors and its relationship with UA configuration during DISE.
- To devise a thorough method of calculating the cost effectiveness of DISE in clinical practice.
- To assess and study the characteristics of central apnea during DISE taking into account that esophageal pressure measurement is regarded as the gold standard measurement of respiratory effort.
- To standardize the methods for application of a reproducible mandibular advancement during DISE in order to mimic OA wear in an appropriate fashion.
- To increase the reproducibility of the mouth closing during DISE taking into account the importance of vertical opening in relation to UA resistance.
- To improve the knowledge of sedative agents effects on UA and central nervous system, for achieving a better protocol of sedation.

CONCLUSION

After the first European Position Consensus Meeting on DISE and its update, consensus was reached on indications, required preliminary examinations, where to perform DISE, technical equipment required, staffing, local anesthesia, nasal decongestion, other medications, patient positioning, basics and special diagnostic maneuvers, drugs and observation windows. So far, no consensus could be reached on a scoring and classification system. However, regarding this aim, the idea of an essential classification, such as VOTE with the possibility of its graded implementation of information and descriptions, seems to be the best way to reach a universal consensus on DISE classification at this stage. A

common DISE language is mandatory and attempts to come to a generally accepted system should be pursued.

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FIGURE LEGENDA:

FIGURE 1: Complete anteroposterior collapse in the velum region

FIGURE 2a-b: Circumferential collapse in the velum region

FIGURE 3a-b: Lateral wall collapse in the velum and lateral pharyngeal walls

FIGURE 4a-b: Epiglottic trapdoor phenomenon

FIGURE 5a-b: Tongue base collapse due to lingual tonsil hypertrophy

FIGURE 6a-b: Tongue base collapse due to muscle relaxation

TABLE N°1

Sedative Agents	Advantages	Disadvantages
Propofol	● quick safe manageable ● less muscle relaxation ● easier control of titration	● Technique dependent (MCI or TCI)
Midazolam	● longer and more stable examination window ● midazolam antidote available	● More difficult to handle in case of overdosing ● Longer hospital stay
Combined (P+M)	● Quicker and more stable mimicking of natural sleep ● midazolam antidote available	● Technique dependent (MCI or TCI) ● Increases sneezing

TABLE N°2

Shedule	Drug dosage	
	MIDAZOLAM	PROPOFOL
Propofol alone		TCI (effect site concentration): Starting dose: 2.0-2.5 µg/ml If required, increase dose of 0.2 – 0.5 µg/mL every 2 minutes
		Manually controlled infusion: Delivering dose: 50-100ml/h
		Bolus technique Proposal 1, starting dose: 30–50 mg, increasing rate of 10 mg every 2min. Proposal 2, starting dose: 1 mg/kg, increasing rate of 20 mg every 2 min.
Midazolam alone	BOLUS TECHNIQUE: Starting dose: 0.05 mg/kg Observe 2 – 5 min If required, increase *dose* of 0,015 - 0.03 mg/kg	

Midazolam and Propofol	MIDAZOLAM SINGLE BOLUS BEFORE ADMINISTRATION OF PROPOFOL: Single starting dose: 0.05 mg/kg	Propofol TCI (effect site concentration) *: Starting dose: 1.5 – 3.0 µg/mL If required, increase *dose* of 0.2 – 0.5 µg/mL

TABLE N°3

AUTHOR	YEAR	SEMIQUANTITIVE/ QUALITATIVE
Croft	1991	Qualitative
Pringle	1993	Qualitative
Camilleri	1995	Qualitative
Quinn	1995	Qualitative
Sadaoka	1996	Qualitative
Higami	2002	Qualitative
Iwanaga	2003	Qualitative
Kezirian	2011	Qualitative
Vicini	2012	Semiquantitative
Bachar	2012	Qualitative
Victores	2012	Qualitative
Gillespie	2013	Qualitative
Koo	2013	Qualitative
Vroegop	2014	Qualitative
Woodson	2014	Qualitative
Lee	2015	Semiquantitative
Herzog	2015	Semiquantitative
Carrasco-Llatas	2016	Qualitative
Veer	2016	Semiquantitative
Spinowitz	2017	Qualitative

APPENDIX 1

DRUG INDUCED SLEEP ENDOSCOPY: STANDARD REPORT FORMAT EXAMPLE
SEDATIVE AGENT(S) APPLIED : Method of Sedation : e.g. TCI, manually controlled infusion Effective site concentration : Lower oxygen saturation: Setting : BIS, CSI, online cardiorespiratory monitoring, bite simulator V. Comment: O. Comment T. Comment E. Comment: Overall comments: Maneuvers: Head rotation evidences Mandibular advancement Trans oral approach Conclusions: