European position paper on drug-induced sleep endoscopy : 2017 update

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

INTRODUCTION

The first edition of the European position paper on DISE has been 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 specialist 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 drug-induced sleep endoscopy (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 ~~o~~the European position paper on DISE, in order to include new evidences and to find a common language useful for reporting the findings of this~~e~~ endoscopic evaluation in patients with sleep-disordered breathing.

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~~we~~ have decided to adopt the term Drug-Induced Sleep Endoscopy (DISE), which better describes the condition of a non-~~t~~-natural sleep achieved during the endoscopy using sedative drugs and because it is more accepted and commonly use in the literature. If the procedure is performed during the natural sleep, it should be useful to use the definition of Natural Sleep Endoscopy (NSE).

INDICATIONS

As DISE provid~~giv~~es additional information about upper airway (UA)~~UA~~ site(s) and pattern(s) of narrowing and obstruction in OSA and snoring, it should be performed in selected patients in whom this additional information about the dynamics of the UA is considered useful. Therefore, DISE should be performed in patients affected by socially disturbing snoring and OSA, in

whom UA anatomical pharyngeal collapsibility represents the predominant pathophysiological factor of SBD [**9**].

Furthermore, DISE may be performed in selected patients who have failed CPAP therapy or who encounter difficulties in tolerating CPAP, as reasons for failure or difficulty in tolerating CPAP could be potentially highlighted. In addition, DISE could provide further information in patients in whom previous surgery has failed and may allow the clinician to recommend either OAT, PT or further surgical intervention addressing the remaining causes of UA collapse that may be causing residual symptoms [**10, 11**]. Recently, it has been described that DISE is useful to be performed in patients with incomplete response to OAT as DISE with and without mandibular advancement device can help to identify the residual anatomical locations of UA collapse, directing additional medical and surgical treatment options to augment the clinical effectiveness of the mandibular advancement device therapy (reference = Kent DT, Rogers R, Soose RJ. Drug-Induced Sedation Endoscopy in the Evaluation of OSA Patients with Incomplete Oral Appliance Therapy Response. Otolaryngol Head Neck Surg 2015; 153: 302-7).

On the other hand, the information about UA collapse observed during DISE might lead to suggesting CPAP treatment in patients with mild OSA[**12**].

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.

REQUIRED PRELIMINARY EXAMINATIONS AND PATIENT'S SELECTION

The Working Group recommends obtaining the following preliminary examinations before performing DISE: types 1, 2, or 3 sleep studies according to American Academy of Sleep Medicine (AASM) [**13, 14**]. The ENT ~~sleep~~ specialist that performs DISE must always keep in mind that DISE is a snapshot of the patient's UA obstruction, but it cannot replace a full night sleep study in order to know the type and the severity of the sleep breathing disorder. Clinical and endoscopic awake UA examination is also essential as some characteristics of the patient are better observed while is

awake. According to the local departmental guidelines, other kind 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 (as small as possible). 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 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)[**15–23**]. Desirable facilities include documentation (video, audio**)**.

STAFFING

The following essential setting is required (Adult Sedation Guidelines, NHS, 2010) [**24**]: The clinicians who perform the endoscopic procedure. An individual, whose sole responsibility is to monitor the patient and observe their response to the medication and the procedure. This could be an anesthesiologist or an appropriately clinically trained individual. A third person has to be available in order to perform basic and advanced maneuvers (mouth closing, pull up, h~~H~~ead rotation, etc.).

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[**25–29**]. These preparatory measures can potentially interact with UA and breathing control and therefore have to be used with caution. UA suction may be necessary during DISE if hypersalivation occurs. This could be the case in 5–10 % of patients, and suction would assist in obtaining a

better UA assessment during the exam. 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 result in a significant change of 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[**30**]. 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

The procedure is commenced in the ~~standard~~ supine ~~primary~~ position, with or without pillow(s) according to the patient's usual sleep habit. The background is that, traditionally, DISE is performed in the "worst" sleeping position, namely the supine position. Currently, position is more and more considered to be an important component in mild to moderate OSA and positional therapy is gaining momentum in the treatment of positional form of OSA (POSA) [31], both as single treatment option, or combined with OAT [32] or after failed upper airway surgery [33]. Therefore, if the patient's sleep study or clinical history is suggestive of POSA (non-supine position AHI less than 5 per hour or less than 50% of the supine position AHI, which is the case in >50% of mild OSA patients), then the DISE could be started in non-supine position, followed by assessment in supine position thereafter. Safiruddin et al. evaluated DISE results in lateral head and trunk position compared to only lateral head rotation. Both manoeuvres showed almost similar results, which suggest that sometimes the upper airways in lateral position can also be evaluated by only rotating the head [34, 35]. Further studies are needed to confirm if head tilting results in the same effects of totally body rotation.

~~The basic~~Another diagnostic tool on top of standard DISE is the trans-nasal 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.

It should be borne in mind that there may be a possibility that an oral appliance (OA) may be a useful treatment modality and so 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 [36, 37]. There is evidence that a hyperprotrusion/maximal protrusion of the mandible has no predictive value towards the OA therapy outcome [37]. Therefore, performing a maximal mandibular protrusion maneuver is not advisable. If the patient's OA is available during the DISE procedure, the Working Group recommends starting the sedation process with the OA in situ and after the assessment of the UA with the OA, to remove it and reassess in order to avoid arousals. This would inform the clinician on the efficacy of the OA and would also allow determining if further advancement of the OA 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 [38].

DRUGS

There is a great variability on the drug or combination of drugs used for DISE reported in the literature. Basically midazolam and propofol ~~there~~ are the two drugs most widely used (~~midazolam, propofol~~). They ~~that~~ can be used alone or in combination between them or other drugs like remifentanil or ketamine in order to sedate the patient. It is important to have some knowledge of the physiology of these drugs in order to be able to perform DISE in a reliable way. The working group recommends to read the articles published by Ehsan et al. and Shteamer et al. for a comprehension beyond the scope of this paper [39, 40].

Most of the evidence that compares natural sleep and sedation is performed with propofol or midazolam as an only agent for sedation. The addition of remifentanil to propofol increases the desaturation of the patient, therefore is not advisable despite its potential to reduce sneezing [**41**].

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

TABLE N°1

Sedative Agents	Advantages	Disadvantages
Propofol	• quick safe manageable • less muscle relaxation • easier control of titration	• Technique dependent (pump 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 (pump or TCI) • Increases sneezing

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

1. Propofol:
TCI (brain concentration)
Basic mode (variations are possible according to team experience)—starting dose, 2.0μg/ml, if required, increasing rate 0.2–0.5 every 2 minutes x number of increasing rate delivered according to multiparametric observations (vibration collapse and respiratory drive and SatO2), up to freeze at the observation window.
Pump (blood concentration)—delivering dose, 50– 100ml/60 min, up to freeze at the observation window.

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

2. Midazolam:
Bolus technique (variations are possible according to team experience)—loading dose, 0.05 mg/kg, observe for 2–5 min, increasing rate of 0.03 mg/kg only if patient is awake, then wait 5 min, if patient is not completely asleep further increasing rate if needed of 0.015 mg/kg
Pump—no shared experiences and evidences in literature
3. Combined (variations are possible according to team experience)
Midazolam—single bolus, starting dose of 0.05 mg/kg
Propofol—2 min later start TCI, loading dose of 1.5–3.0μg/ml, if required, increasing rate 0.2–0.5, x number of increasing rate delivered according to multiparametric observations (vibration collapse and respiratory drive and SatO2), up to freeze at the observation window.

TABLE N°2

Shedule	Drug dosage	
	MIDAZOLAM	PROPOFOL
Propofol alone	[redacted]	TCI (brain concentration): Starting dose: 3.0 μg/ml If required, increase with rate of 0.2 – 0.5 μg/mL
		PUMP (blood concentration): Delivering dose: 50 – 100 ml/hour

	[redacted]	BOLUS TECHNIQUE (blood concentration): Starting dose: 30 – 50 mg or 1 mg/kg If required, increase with rate of 10 - 20 mg
Midazolam alone	BOLUS TECHNIQUE (blood concentration): Starting dose: 0.05 mg/kg Observe 2 – 5 min If required, increase with rate of 0.015- 0.03 mg/kg	[redacted]
Midazolam and Propofol	SINGLE SHOT BEFORE ADMINISTRATION OF PROPOFOL: Single starting dose: 0.05 mg/kg or 1.5 mg	TCI (brain concentration)*: Starting dose: 1.5 – 3.0 µg/mL If required, increase with rate of 0.2 – 0.5 µg/mL

The working group recommends to use a TCI pump if propofol is the sedative drug used, as the sedation is more stable and reliable than when the bolus technique is employed [**42, 43**]**.** As most of the patients achieve the adequate sedation level sedation at a TCI concentration of 3.2 µg/Ml [**44**], the working group recommends to set the TCI pump to a concentration of 3µg/mL in order to achieve the desired level of sedation. Recently Dexmedetomidine has been proposed as a new sedative agent for DISE procedure. Dexmedetomidine is an alpha 2 receptor agonist, which mechanism of sedation is to inhibit the locus ceruleous; it also has analgesic properties. Comparing with propofol and midazolam, dexmedetomidine induces a state of sedation closer to natural sleep and lesser UA muscular relaxation, even at the increased anesthetic dosage. Otherwise, Dexmedetomidine is characterized by a slightly longer onset of action (5-10

minutes), and patients take longer timing to recover. Regardless, further studies are needed before suggesting it as a standard sedative agent for DISE[**45**].

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. Central apneas can be watched also at the beginning of sedation if propofol is injected too fast, therefore more cycles may be required if the bolus technique is used.

Met opmerkingen [O1]: Remark regarding the use of capitals: either always for medication names either never

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 used over 60 during the procedure, obtaining a medium-sedation level status, consisting in loss of consciousness, defined as loss of response to verbal stimulation at a normal volume, comparable to a modified Ramsay sedation score of 5 [**46, 47]**. Although some studies have shown that the collapsibility of the UA increases with the depth of the sedation[**21, 44, 48, 49]**, 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, 23, 44, 47, 50**]. This BIS values may not be the same if dexmedetomidine is the drug used. However, further research is needed on the validation of using EEG derived indices during DISE, as well as with polygraphic ~~realtime~~real-time monitoring.

LIST AND DEFINITIONS OF THE TARGET EVENTS

– Pharyngeal and/or laryngeal vibration (snoring), without obstruction, with partial obstruction

– Pharyngeal and/or laryngeal obstruction—partial, complete, anteroposterior, circumferential, lateral wall collapse, laryngeal stridor, involvement of ary-epiglottic folds, and epiglottic trapdoor phenomenon (**Figs. 2, 3, 4,5, 6, and** 7).

SCORING AND CLASSIFICATION SYSTEMS

Several DISE scoring and classification systems are reported in the literature (**Table 3**) [**2, 29, 51–67**].

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. According to the TNM classification [**68**], 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 postcricoid 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 [**69**].

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, nasopharynx, and glottis does 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. The same arguments hold true for the larynx; the larynx only very rarely plays a role in OSA, while assessment in awake situation is feasible. The results of the

examination do not differ during awake and sleep states (e.g., a mobile larynx in the awake state does not change in an immobile larynx during sleep). There was discussion however on the levels/structures in between the nose/nasopharynx and glottis. 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 classification system [**57**]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. Other 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 (f.e. 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~~s~~ 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.

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	Semi-quantitative
Bachar	2012	Qualitative
Victores	2012	Qualitative
Gillespie	2013	Qualitative
Koo	2013	Qualitative
Vroegop	2014	Qualitative
Woodson	2014	Qualitative
Lee	2015	Semi-quantitative
Herzog	2015	Semi-quantitative
Carrasco-Llatas	2016	Qualitative
Veer	2016	Semi-quantitative
Spinowitz	2017	Qualitative

APPENDIX 1

DRUG INDUCED SLEEP ENDOSCOPY: STANDARD REPORT FORMAT EXAMPLE
SEDATIVE AGENT(S) APPLIED :

Method of Sedation : f.e. TCI, manual

Concentration :

Lower oxygen saturation:

Setting : BIS, CSI, online cardiorespiratory monitoring, byte simulator

V. Comment:

O. Comment

T. Comment

E. Comment:

Overall comments:

Maneuvers:

Head tilting evidences

Mandibular advancement

Trans oral approach **Conclusions**

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 [**70**]. 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 [**71**]. 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. (ref). 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.

Met opmerkingen [O2]: Ref=Observervariationin drug-induced sleep endoscopy: experienced versus nonexperienced ear, nose, and throat surgeons. Vroegop AV, Vanderveken OM, Wouters K, Hamans E, Dieltjens M, Michels NR, Hohenhorst W, Kezirian EJ, Kotecha BT, de Vries N, Braem MJ, Van de Heyning PH.
Sleep. 2013 Jun 1;36(6):947-53. doi: 10.5665/sleep.2732.

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 s~~S~~edation level reached as assessed by EEG derived

signal (BIS, CSI, or others) ~~reached during the examination~~ if they~~it~~ ha~~ve~~s been used during the examination, and, finally, the modification of the UA obstruction pattern, if 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 ~~easier~~ 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~~on~~ 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 relation 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.

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. ~~It is disappointing that~~ S~~s~~o far no consensus ~~has~~ could be~~en~~ reached on a scoring and classification system. However, regarding this~~With 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 have to be pursued.

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