

The Dysphonia Severity Index (DSI)

Basics and Clinical Interpretation, Marc S. De Bodt, Floris L. Wuyts - University of Antwerp

Basics

The Dysphonia Severity Index (DSI) is designed as an objective and quantitative correlate of voice quality. It is based on a multivariate analysis of an extended database of more than 1000 normal and pathologic voices for the multi-center study trial initiated by the Belgian Study Group on Voice Disorders (Van de Heyning, et al., 1996). Per patient, more than 45 voice characteristics and measurements were collected. Additionally, the voice quality as perceived by the clinician and expressed by means of the grade of hoarseness was obtained for all subjects (G from the GRBAS scale: normal, light, moderate or severe: Hirano, 1981). The Dysphonia Severity Index was then constructed by a multivariate statistical approach that calculated a combination of weights variables such that the different types of voices according to the perceived voice quality (G) were optimally identified. This resulted in only four voice characteristics: maximum phonation time (MPT, sec.) highest frequency (Fo-high, Hz), lowest intensity (I-low, dB(A)) and jitter (%). The calculated weights are given in the following expression:

$$\text{DSI} = 0.13 \cdot \text{MPT} + 0.0053 \cdot \text{Fo-high} - 0.26 \cdot \text{I-low} - 1.18 \cdot \text{jitter} + 12.4$$

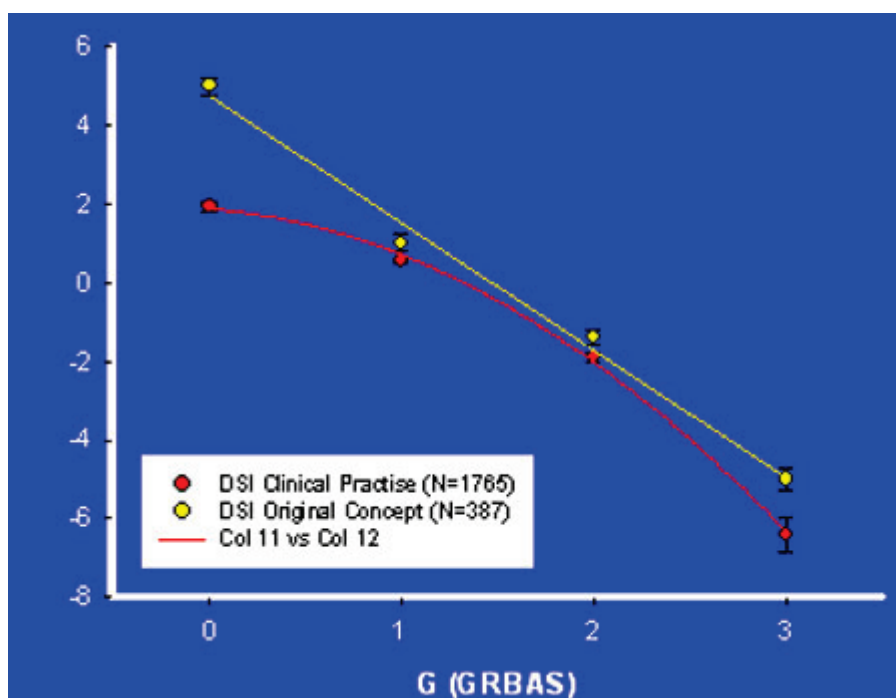


Figure 1 illustrates the relation between DSI and the parameter "G" as described in the GRBAS-scale (Hirano, 1981). The yellow line shows the linear relation that was shown in the original concept. The red line is the result of an analysis of a large clinical database and

shows a similar trend. G0 and G3 correspond with lower DSI values which is in agreement with our clinical experience.

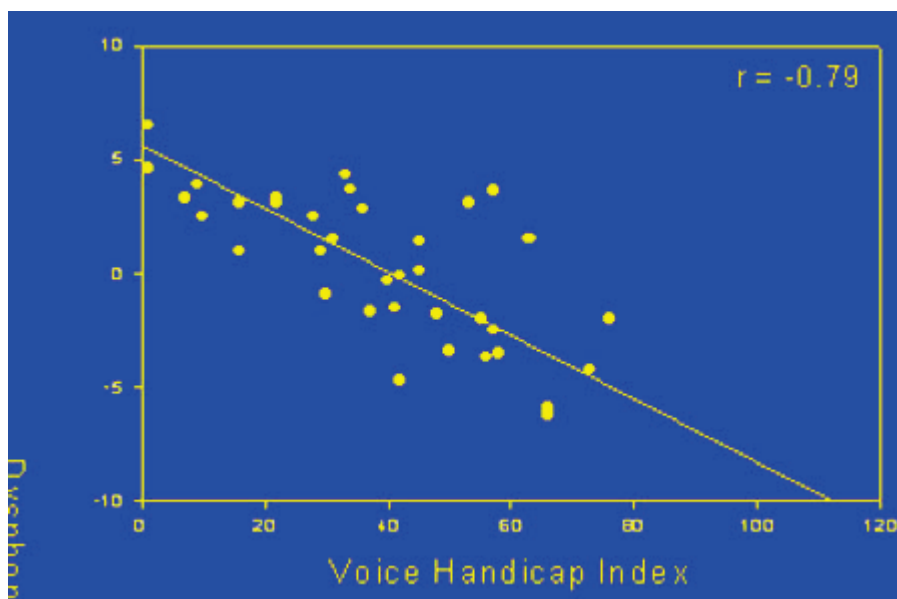


Figure 2 illustrates the correlation between DSI and the Voice Handicap Index (Jacobson, 1997).

Clinical application

The DSI expression is calculated with lingWAVES Phonetogram Pro in a few minutes. The procedure to achieve the DSI is described elsewhere in this manual. The DSI is a continuous measure with two anchor points: +5 for normal voice and -5 for severely bad voice (poor quality). It can exceed however these anchor points in case of respectively excellent or extreme bad voices. When the DSI is above 1.6, it can be considered as being normal, given the wide range of normal voices.

There is no gender effect. This may seem odd since it contains the highest frequency, but it also contains the maximum phonation time. Both variables have opposite characteristics for male and female persons, what cancels out the gender effect.

The DSI is based on voices of adult controls and adult patients. As such the DSI for children and elderly may be different from the expected values for adults. Preliminary results of running research show that for both groups lower DSI values are valid.

Relation G-levels-DSI

G0	<=>	DSI = 5.0
G1	<=>	DSI = 1.0
G2	<=>	DSI = -1.4
G3	<=>	DSI = -5.0

The Error calculated for the DSI is 0.6.

These values can be used as guidelines, but it is even more important to look for changes in time within a specific case. Difference in sampling rate, microphone type, measuring procedure etc. may cause variability in DSI with respect to the anchor points, but when similar protocols and measurement practices are used, little variation is expected.

The DSI is very sensitive for small changes in voice quality that often are not noticed by the patient or the clinician.

DSI related to levels of impairment

For the level of impairment of voice (as defined in the Therapy Outcome Measures (TOM) by Enderby (1997) we developed a corresponding DSI based on the analysis of the database of the Belgian Study Group on voice Disorders (Van de Heyning, et al., 1996) which contains more than 1000 cases.

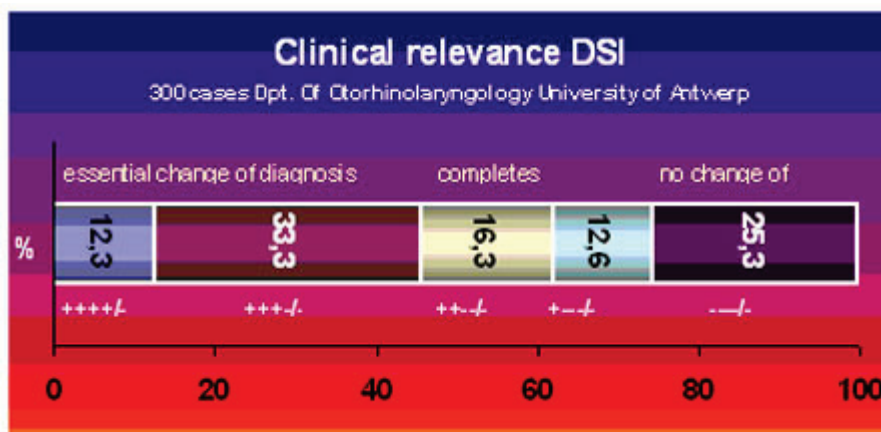
	TOM	DSI
0	Severe persisting aphonia: patient has no voice, is unable to phonate	< - 4.3
1	Constant dysphonia: Sporadic periods of phonation, aphonic periods may be present	- 4.2 to -2.3
2	Moderate dysphonia: patient can produce voice, but there are frequent periods of dysphonia	-2.2 to -0.4
3	Slight to moderate dysphonia: less frequent periods of disturbed phonation or slight persisting dysphonia	- 0.3 to 0.7
4	Slight dysphonia: sporadic dysphonic moments for short periods	0.8 to 1.7
5	No dysphonia	> 1.8

Added value of the DSI

What is the added value of the DSI in diagnosis ?

When all individual measures (MPT, Highest frequency, Lowest intensity, Jitter) of the DSI indicate a negative (----) direction, the DSI does not reveal any supplementary information (-) because there is no contradiction between single results. The correct interpretation becomes more difficult when some measures are good and others bad (e.g. ++--). So, to investigate the supplementary information provided by the DSI we analysed 300 consecutive clinical cases from the Antwerp University Voice Clinic. In almost 75 % of the cases, the DSI revealed supplementary information (essential change of diagnosis) or refined the interpretation (completes) and only in 25% there was no added value. This is because the weighted combination of several measures is much more informative than a single measure.

The DSI can therefore be used as an objective tool for the assessment of voice quality, taking into account several measurements at once.



References

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