The Relationship Between Subjective Self-rating And Objective Voice Assessment Measures

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Comprehensive Voice Evaluation
Objective and Subjective

Voice Disorders

Voice Dysfunction

APA
Acoustic analysis

VHI
V-RQOL
VoISS

Protocol of Voice Evaluation

Voice Impact
Aim of the Study

- Evaluate the relationship between patient self rating voice assessment and the objective voice measures.

Subaims:
- Validation of a self rating voice scale, reflecting main complaints and voice impact and quality of life.
- Evaluate the reliability of objective measures including the Dysphonia Severity Index in reflecting the severity of voice change.
- Determine the correlation between patient self rating voice assessments and the objective voice measures.

Subjects

- Pilot study.
- Subjects:
  - Patients having voice disorders
  - Control (no voice complaints)
Methodology: Protocol of Voice Assessment

- **Elementary diagnostic Procedures:**
  - Patient's interview
  - Auditory perceptual assessment

- **Clinical diagnostic aids:**
  - Augmentation and documentation of the glottis using:
    - Videolaryngostroboscopic examination.
  - Voice recoding

- **Additional diagnostic measures:**
  - Acoustic Analysis (Multi Dimensional Voice Program and Visipitch).
  - Aerodynamic measures: (Voice Function Analyzer Aerophone II).

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Voice Quality Assessment

**Quasiobjective: Auditory Perceptual Assessment (GRBAS)**

- Seven judges: Interrater Reliability
  - G (Alpha=0.948, Correlation coefficient: r=0.731)
  - R (Alpha=0.889, Correlation coefficient: r=0.881)
  - A (Alpha=0.427, Correlation coefficient: r=0.444)
  - S (Alpha=0.774, Correlation coefficient: r=0.751)

**Objective Voice Measures**

- Acoustic Measures (MDVP)

  Dysphonia Severity Index (DSI)
  
  $D = (0.13\times MPT) + (0.0053\times F0\text{-high}) - (0.26\times I\text{-low}) - (1.18\times \text{jitter}) + 12.4$

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1. Hirano MC. Clinical Examination of voice. Wein; New York: Springer; 1981
Voice Problem Self-rating Scale (VPSS)

- 40 Questions
- Scale: five-point scale
- Four Clusters:
  - Functional
  - Physical
  - Emotional
  - Phonasthenic
- Total score

Reliability of VPSS

<table>
<thead>
<tr>
<th></th>
<th>Cronbach’s alpha</th>
<th>Correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td>.922</td>
<td>.881</td>
</tr>
<tr>
<td>Physical</td>
<td>.712</td>
<td>.573</td>
</tr>
<tr>
<td>Emotional</td>
<td>.912</td>
<td>.944</td>
</tr>
<tr>
<td>Phonasthenic</td>
<td>.903</td>
<td>.824</td>
</tr>
<tr>
<td>Total</td>
<td>.854</td>
<td>.756</td>
</tr>
</tbody>
</table>

Alpha:>0.7 acceptable, >0.8 good and >0.9 excellent
Reliability coefficient = <0-0.25 weak, 0.25-0.75 moderate reliability, 0.75-<1 strong reliability and 1 is optimum.
**Internal Consistency and Item to Total Consistency of VPSS**

<table>
<thead>
<tr>
<th></th>
<th>Functional</th>
<th>Physical</th>
<th>Emotional</th>
<th>Phonasthenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>.852 (**)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>.892 (**)</td>
<td>.878 (**)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phonasthenia</td>
<td>.559 (**)</td>
<td>.763 (**)</td>
<td>.679 (**)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>.680 (**)</td>
<td>.961 (**)</td>
<td>.951 (**)</td>
<td>.810 (**)</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed).**

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**Convergent Validity with VHI**(1)

<table>
<thead>
<tr>
<th></th>
<th>VPSS</th>
<th>Social</th>
<th>Physical</th>
<th>Emotional</th>
<th>Total VPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>.902 (**)</td>
<td>.804 (**)</td>
<td>.842 (**)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>.714 (**)</td>
<td>.898 (**)</td>
<td>.772 (**)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional</td>
<td>.835 (**)</td>
<td>.829 (**)</td>
<td>.935 (**)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total VHI</td>
<td>Pearson’s Correlation VHI and Total VPSS</td>
<td>r=.931  p=.000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed)

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Data management of:
- APA(GRBAS)
- MDVP: Acoustic parameters
- Aerodynamic parameters
- DSI
- VPSS

Statistical Analysis

Results

Pilot study
Distribution of Studied Group

Control: Age: 36.4 ±9.42
Patient: Age: 40.07 ±14.92

Voice Categorical Distribution

Non organic: 19%
Organic: 17%
MAP: 52%
Neurogenic: 12%
Patients Vs. Control

VPSS mean scores were significantly different between Patients and Control

Distribution according to degree of Dysphonia

G1 14%
G2 38%
G3 48%

27th Alexandria International Combined ORL Congress, April 8-10, 2009
### VPSS & GRBAS

<table>
<thead>
<tr>
<th></th>
<th>Functional</th>
<th>Physical</th>
<th>Emotional</th>
<th>Phon-asthenic</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>r=0.744**</td>
<td>r=0.680**</td>
<td>r=0.727**</td>
<td>r=0.668**</td>
<td>r=0.646**</td>
</tr>
<tr>
<td></td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
</tr>
<tr>
<td>R</td>
<td>r=0.690**</td>
<td>r=0.773**</td>
<td>r=0.688**</td>
<td>r=0.713**</td>
<td>r=0.783**</td>
</tr>
<tr>
<td></td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
</tr>
<tr>
<td>B</td>
<td>r=0.079</td>
<td>r=0.238</td>
<td>r=0.186</td>
<td>r=0.373*</td>
<td>r=0.230</td>
</tr>
<tr>
<td></td>
<td>p=0.000</td>
<td>p=0.075</td>
<td>p=0.166</td>
<td>p=0.004</td>
<td>p=0.055</td>
</tr>
<tr>
<td>A</td>
<td>r=0.330*</td>
<td>r=0.335*</td>
<td>r=0.257*</td>
<td>r=0.315*</td>
<td>r=0.333*</td>
</tr>
<tr>
<td></td>
<td>p=0.012</td>
<td>p=0.011</td>
<td>p=0.057</td>
<td>p=0.017</td>
<td>p=0.010</td>
</tr>
<tr>
<td>S</td>
<td>r=0.628**</td>
<td>r=0.660**</td>
<td>r=0.532**</td>
<td>r=0.514**</td>
<td>r=0.642**</td>
</tr>
<tr>
<td></td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
<td>p=0.000</td>
</tr>
</tbody>
</table>

*Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

### VPSS Clusters and Grade of dysphonia (G)

![Graphs showing VPSS Clusters and Grade of dysphonia (G)](image-url)
Boxplots for VPSS Clusters and G

Blockplot For Total VPSS Score and G
VPSS in Various Voice Disorders

![Bar Chart](chart)

**Acoustic Parameters: Patients Vs Control**

- **Voice break**: DVB, NVB
- **Sub-Harmonic**: DSH, NSH
- **Voice irregularity**: DUV, NUV

**Tremor parameters:**
- FTRI
- ATRI
- FFTR
- AFTR

**Fundamental frequency parameters**
- Fo
- Fhi
- Flo
- STD
- PFR**

**Short and long term frequency perturbation**
- Jita
- Jitt
- RAP
- PPQ
- sPPQ*
- vFm

**Short and long term amplitude perturbation**
- ShdB
- Shim
- APQ
- sAPQ
- vAm

**Noise related parameters:**
- NHR*, VTIs, SPI*

*p<0.05 significant

**p<0.001 highly significant
Aerodynamic Measures: Patients vs control

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPT</td>
<td>3.526</td>
<td>.001</td>
</tr>
<tr>
<td>Max SPL</td>
<td>-3.420</td>
<td>.001</td>
</tr>
<tr>
<td>Phon SPL</td>
<td>-4.455</td>
<td>.001</td>
</tr>
<tr>
<td>Psub</td>
<td>3.482</td>
<td>.001</td>
</tr>
<tr>
<td>Mean Power</td>
<td>3.328</td>
<td>.001</td>
</tr>
</tbody>
</table>

Significant at p = < 0.05
Highly significant at p = < 0.001

T-test

Predictor Parameters
VPSS & Acoustic and Aerodynamic Measures

Total VPSS
$r^2=0.735$ $p<0.001$

Functional
$r^2=0.615$ $p<0.001$

Physical
$r^2=0.423$, $p<0.001$

Phonasthenic
$r^2=0.280$, $p<0.001$

Emotional
$r^2=0.591$, $p<0.001$

Stepwise Multiple Regression
Predictor Parameters:
Acoustic measures and VPSS

Stepwise multiple regression

Dysphonia Severity Index:
Patient Vs Control

Patient

3.49

Control

2.41

t-value = 4.676, p = .000
Highly significant p = <0.001
DSI & GRBAS

- ANOVA
  - $F=11.772 \ P=.000$
- Pearson’s correlation

<table>
<thead>
<tr>
<th></th>
<th>G</th>
<th>R</th>
<th>B</th>
<th>A</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSI</td>
<td>$r=0.628^{**}$</td>
<td>$r=0.680^{**}$</td>
<td>$r=0.307^*$</td>
<td>$r=0.452^{**}$</td>
<td>$r=0.567^{**}$</td>
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<tr>
<td></td>
<td>$p=0.000$</td>
<td>$p=0.000$</td>
<td>$p=0.000$</td>
<td>$p=0.000$</td>
<td>$p=0.000$</td>
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** Correlation is significant at the 0.01 level (2-tailed).

DSI & Total Score of VPSS

$r=-.487 \ (.000)$
### Conclusion

- VPSS reflects impact of the problem on the patient. It is related to the overall grade of severity, roughness and strained quality of voice.

- VPSS is highly reflecting voice problems in both non-organic and minimal associated pathological lesions.

- Acoustic (Shim, APQ and NHR) and aerodynamic measures (MPT) contributed to Total VPSS and emotional Clusters Scores. Physical and functional clusters shared various combinations of these variables. Psub was the only predictor variable for Phonasthenic clusters scores.
**Total VPSS Scores and DSI**

ANOVA. $F=24.733$, $p=.000$

**Conclusion**

- DSI significantly differentiate between patient and control and is significantly correlated to overall grade of dysphonia.

- DSI moderately correlates with Clusters of VPSS in particular physical and phonasthenic Cluster.

- DSI and VPSS may differentiate some of the voice disorders.
Mean Total Scores of VPSS in Various Voice Disorders

ANOVA(F=13.591,p=.000)  
ANOVA(F=6.085,p=.000)

Recommendation

- VPSS is recommended as a tool for evaluating impact of voice problem.
- VPSS and DSI should be conducted on large dysphonic population having different vocal demands with different emotional and personality characters.
- Self rating scales should be integrated with objective measures for voice evaluation to develop a voice severity scoring scale.
Thank you