Chapter 25
VSK in the assessment of unilateral and bilateral vocal fold paralysis and/or dysmotility

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Abstract

Qualitative assessment of kymograms and open quotient (OQ) values were obtained from VSK examination of over 300 patients presenting with vocal fold (VF) immobility or dysmobility. Qualitative assessment showed reduced amplitude of VF vibrations in patients with VF immobility. The OQ values for the anterior, middle, and posterior areas of the VF were higher compared to the control group.

Keywords: Videostrobokymography, unilateral VF paralysis, bilateral VF paralysis, crico-arytenoid joint fixation

Introduction

Here we address application of VSK in conditions affecting the mobility of the VF, namely in unilateral (UP) and bilateral (BP) VF paralysis, and in cricoarytenoid joint fixation (CAF).

Materials and methods

The clinical material included 367 patients comprising 10 controls and 357 with dysphonia secondary to VF dysmotility. All cases were examined at the Audiology and Phoniatrics Clinic of the Institute of Physiology and Pathology of Hearing in Kajetany, Warsaw, Poland. Among the dysphonic patients 232 presented with unilateral VF paralysis, 105 with bilateral VF paralysis, and 20 with cricoarytenoid joint fixation.

All patients underwent laryngovideostroboscopic (LVS) exams made with the EndoSTROB DX Xion 327 unit (Xion GmbH, Berlin, Germany, EU) and with transoral rigid scope approach. Recordings were made during production of sustained phonation of the vowel /i/. All kymograms were calculated from these 4-second long recordings using the Xion equipment. All kymograms were based on three line placements representing anterior, middle, and posterior areas of interests. From these VSK we calculated both the open (OQ) and the closed quotients (CQ) for all the pathologies studied.

Results

Mean values and their ranges for the OQ for the clinical group (UP, BP, CAF) and for the controls are presented in Table 1. The values are listed for the three locations along the glottic length, namely, the anterior, the middle, and the posterior glottis.
Table 1. Mean values of OQ in patients with vocal fold immobility and the control group from the anterior, middle, and posterior third of the vocal folds.

<table>
<thead>
<tr>
<th></th>
<th>Anterior</th>
<th>Min, Max</th>
<th>Middle</th>
<th>Min, Max</th>
<th>Posterior</th>
<th>Min, Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>0.56</td>
<td>0.41, 0.68</td>
<td>0.55</td>
<td>0.42, 0.67</td>
<td>0.59</td>
<td>0.40, 0.71</td>
</tr>
<tr>
<td>Unilateral paralysis</td>
<td>0.69</td>
<td>0.65, 0.71</td>
<td>0.65</td>
<td>0.56, 0.74</td>
<td>0.64</td>
<td>0.54, 0.77</td>
</tr>
<tr>
<td>Bilateral paralysis</td>
<td>0.57</td>
<td>0.39, 0.84</td>
<td>0.65</td>
<td>0.52, 0.80</td>
<td>0.61</td>
<td>0.39, 0.78</td>
</tr>
<tr>
<td>Cricoarytenoid joint fixation</td>
<td>0.68</td>
<td>0.64, 0.72</td>
<td>0.72</td>
<td>0.69, 0.74</td>
<td>0.65</td>
<td>0.57, 0.72</td>
</tr>
</tbody>
</table>

*Unilateral paralysis (UP)*

There are multiple reasons for UP [1]. In our group, this condition was mainly due to recurrent laryngeal nerve (RLN) injury during the thyroid surgery and due to idiopathic causation. Of these UP cases, 47% UP were on the right (RUP) and 63% on the left (LUP) side.

LVS images for a RUP are shown in Figures 1-1 and 1-2. The case presented here shows RUP that is well compensated. Based on VSK, the value of OQ in the anterior area was lower compared to the middle and posterior segments of the VF. The OQ values calculated from the anterior, middle, and posterior areas of the VF were higher compared to the control group and these differences were statistically significant (Figures 1-3, 1-4, and 1-5).

At the anterior portion of the glottis in the RUP case, we noted: left-right VF asymmetry, smaller amplitude, phase shift, and irregular oscillations.

At the middle segment, we also noted the left-right asymmetry, shortened closed phase, and a phase shift. Oscillations were predominately irregular.

At the posterior area of the glottis the left-right asymmetry continued. There were also phase shifts, diminished amplitude on the left VF, and shortened closed phase.

*Figure 1-1.* Paralysis of the right VF in abduction.
Figure 1-2. Paralysis of the right VF in adduction.

Figure 1-3. VSK in a patient with RUP, anterior segment of the VF (OQ = 0.65).

Figure 1-4. VSK in a patient with RUP, middle segment of the VF (OQ = 0.74).
Figure 1-5. VSK in a patient with RUP, posterior segment of the VF (OQ = 0.77).

Bilateral paralysis (BP)

LVS images for bilateral paralysis are shown in Figures 2-1 and 2-2. This patient presented with BP. The lowest OQ values were calculated from the anterior and posterior segments of the VF (Figures 2-3, 2-4, and 2-5).

VSK on the anterior segment in the patient with BP showed left-right asymmetry and a slightly diminished amplitude on both sides. Open phase was foreshortened and a phase shift was also noted.

At the middle segment left-right asymmetry and phase shift were apparent. A slightly reduced amplitude on both sides was noted.

At the posterior portion of the glottis left-right asymmetry continued. There were also phase shift, slightly reduced amplitude on both sides, and shortened open phase.

Figure 2-1. BP of the VF in abduction.
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Figure 2-2. BP of the VF in adduction.

Figure 2-3. VSK in a patient with BP, anterior segment of the VF (OQ = 0.39).

Figure 2-4. VSK in a patient with BP, middle segment of the VF (OQ = 0.52).
Figure 2-5. VSK in a patient with BP, posterior segment of the VF (OQ = 0.39).

Cricoarytenoid joint fixation (CAF)

LVS images for bilateral cricoarytenoid joint fixation are shown in Figures 3-1 and 3-2. The case presented here shows bilateral immobility of the VF because of cricoarytenoid joint fixation (that was the consequence of temporary VF paralysis after thyroidectomy for papillary thyroid carcinoma). TheVF are in a paramedian position during inspiration and there is a very slight movement of the arytenoids. Closure of VF during phonation is complete. The lowest values of the OQ are measured from the anterior and posterior segments of the VF (Figures 3-3, 3-4, and 3-5).

At the anterior portion of the glottis slight left-right asymmetry and phase shift were present, and were especially observed in the third and fourth oscillation cycle.

At the middle segment left-right asymmetry and phase shift continued. Closed phase was foreshortened.

VSK from the posterior segment showed left-right asymmetry and phase shift, and shortened closed phase as well.

Figure 3-1. Bilateral CAF VF in abduction.
Figure 3-2. Bilateral CAF VF in adduction.

Figure 3-3. VSK in a patient with bilateral cricoarytenoid joint fixation, anterior segment of the VF (OQ = 0.64).

Figure 3-4. VSK in a patient with bilateral cricoarytenoid joint fixation, middle segment of the VF (OQ = 0.72).
Conclusions

VSK observation of the glottis in the UP and BP are essentially global and do not show significant differences based on location (anterior, middle, or posterior). Of interest are the contrasting data for BP and CAF, and we suggest that VSK can be useful in differential diagnoses of BP vis-à-vis CAF. The major differentiating features between these two conditions include the significantly reduced amplitude of vibration in BP or even lack of vibration in this condition as opposed to the CAF. The glottic closure, OQ, and CQ depend on the distance from the midline of the non-mobile VF and on the degree of compensation of the mobile VF during phonation.

References