Background

- Numerous options have been introduced for the treatment of glottal insufficiency

- Ishihiki’s type I medialization thyroplasty is the main strategy in laryngeal framework surgery

- Drawback
  - Cannot be modified postoperatively without revision surgery despite the various types of implants

- In order to prevent revision thyroplasty, surgeons must have adequate tools to choose the appropriate size of the implant during MT

- SGPS can be measured easily and has been linked to vocal efficiency

- SGPS is statistically higher in dysphonic patients than in healthy subjects
**Background**
- Till now, intraoperative assessment of the adequacy of glottal closure is based on:
  - Physician’s perception
  - Patient comfort
  - Glottal gap based on peroperative fibroscopy for assessment of vocal folds edge apposition
  - Maximum phonation time (Lundy 2004)

**Hypothesis**
- Real time objective measurement of SGP could contribute to the choice of the implant’s size (IS) in medialization thyroplasty (MT).

**Objectives**
- Assess the feasibility of measuring peak direct subglottic pressure (PDSGP) in the setting of MT using the Montgomery implant (MI) in humans
- Study the variation of PDSGP with the variation of MI size

**Methods**
- Prospective study
- Inclusion criteria
  - >18 years
  - Glottal insufficiency
  - Thyroplasty Type I + Montgomery implant
  - Informed consent
- Surgery
  - Supine position
  - Light sedation
  - Local anesthesia (Skin and trachea)
methods

Perceptual assessment
- Breathy vocal quality assessed by operating surgeon and speech pathologist after asking the patient to sustain the vowel /a/ at a comfortable pitch and amplitude, each time the implant model size was changed.

Glottal Closure assessment
- Flexible videoendoscope ENF type VT-2 (Olympus, Lake Success, NY)
- Judgment of glottal closure was subjectively made by the operating surgeon each time the implant model size was changed.

Real time peak subglottic pressure measurement
- Large peripheral venous flexible catheter of 18 GA (BD INSYTE-W™, NJ, USA) through the cricothyroid membrane.
- Connected to the oral pressure sensor of the Phonatory Aerodynamic System (PAS, KayPentax, USA) with a perfusion cable.
- Patient was asked to sustain the vowel /a/ 3 times for each implant size at a comfortable pitch and intensity
- The mean value of the PDSGP was recorded.
- Values were recorded with each size of the Montgomery implant model.

The final implant size was chosen when the perceptual judgment of the patient, surgeon and speech pathologist concurred with the assessment of the glottis gap and the lowest value of the PDSGP.

RESULTS: STUDY 1
Assess the feasibility of measuring PDSGP in the setting of MT using the Montgomery implant in humans

<table>
<thead>
<tr>
<th>Patient</th>
<th>Gender</th>
<th>Age in years</th>
<th>Cause of Glottal insufficiency</th>
<th>PDSGP pre implant in cm H2O</th>
<th>PDSGP post implant in cm H2O</th>
<th>Size of the implant</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>57</td>
<td>Extended cordectomy</td>
<td>14.97</td>
<td>10.46</td>
<td>12</td>
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<td>2</td>
<td>M</td>
<td>52</td>
<td>Extended cordectomy</td>
<td>23.83</td>
<td>16.9</td>
<td>12</td>
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<tr>
<td>3</td>
<td>M</td>
<td>63</td>
<td>Left vocal fold paralysis</td>
<td>14.35</td>
<td>6.9</td>
<td>11</td>
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<tr>
<td>4</td>
<td>M</td>
<td>40</td>
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<td>15.3</td>
<td>14.3</td>
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<td>F</td>
<td>53</td>
<td>Left vocal fold paralysis</td>
<td>10.5</td>
<td>7.8</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>63</td>
<td>Left vocal fold paralysis</td>
<td>12</td>
<td>7.6</td>
<td>8</td>
</tr>
</tbody>
</table>

Mean PDSGP: 15.2, SD (PDSGP): 4

The difference between PDSGP preimplant and PDSGP postimplant was statistically significant (Wilcoxon signed rank test for paired samples: p<0.028).

Patients tolerance of PDSGP measurement was very good.
Study the variation of PDSGP with the variation of MI size.

Males

<table>
<thead>
<tr>
<th>Implant</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>♀ 1</td>
<td>10</td>
<td>7.6</td>
<td>NT</td>
<td>10.1</td>
<td>12</td>
</tr>
<tr>
<td>♀ 2</td>
<td>8.8</td>
<td>9.8</td>
<td>12.1</td>
<td>NT</td>
<td>NT</td>
</tr>
<tr>
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<td>10.9</td>
<td>11.9</td>
<td>16.24</td>
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</table>

Females

<table>
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<tr>
<th>Implant</th>
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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>♂ 1</td>
<td>25.4</td>
<td>21.0</td>
<td>22.5</td>
<td>24.4</td>
<td>27.5</td>
<td>NT</td>
</tr>
<tr>
<td>♂ 2</td>
<td>21.8</td>
<td>16.7</td>
<td>23.0</td>
<td>20.6</td>
<td>20.2</td>
<td>19.3</td>
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</tbody>
</table>

Results: Study 2

In the surgical setting of MT the invasive nature of the placement of the transducer for the measure of SGP does not apply.

We used peak subglottic pressure, because according to Ketelslagers et al, under normal pitch and intensity conditions, there is a significant difference of the peak SGP between patients with vocal fold pathology and controls.

discussion

We observed that the PDSGP diminished when the glottis area was reduced by the approximation of the vocal fold until an optimal position was reached. After this position, the augmentation of the size on the MI implant produced an increase of the PDSGP.

DPSG was measured in the supine position under sedation.

This could modify its value compared to the pre/postoperative measures.
Per operative measurement of PDSGP is feasible and it does not induce patient related side effects
The use of the Phonatory Aerodynamic System did not seem inconvenient or bulky
DPSGP will give an intraoperative objective real time assessment of vocal efficiency
However, more patients should be included in the study to confirm its utility

References
10. 2000; 107:24
Anesthesia

Intravenous dosages of an opioid for pain control (Remifentany).
- A benziodazepam (Midazolam) as well as a short acting hypnotic agent (Propofol) were used for amnesic/anxiolytic effect.
- A synthetic anticholinergic agent (Glycopyrrolate) was used to decrease salivary secretion.
- Local injection of analgesic (lidocaine 1%, epinephrine 1/200000) was used as needed to control pain.