CHAPTER

LONG-TERM EFFICACY OF VOICE THERAPY IN PATIENTS WITH VOICE PROBLEMS AFTER TREATMENT OF EARLY GLOTTIC CANCER

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ABSTRACT

Objective The purpose of the present pilot study is to investigate whether the beneficial short-term effects of voice therapy in patients with voice problems after treatment of early glottic cancer as reported in our earlier study remain present on the long term.

Study Design In this prospective study, 12 patients, selected based on a screening questionnaire about voice problems and randomly assigned for treatment with voice therapy (vs no treatment), were evaluated with a mean of 13 months after finishing voice therapy to evaluate the long-term voice effects.

Methods Voice assessment consisted of the Voice Handicap Index (VHI) and acoustic analyses (percent jitter, percent shimmer, and noise-to-harmonics ratio).

Results Statistical analysis showed that the beneficial short-term effect on the mean VHI, percent jitter, and shimmer remained stable after more than a year of follow-up.

Conclusions The present study provides initial evidence that the beneficial effect of voice therapy is not just a short-lived voice improvement but may result in a better voice for a period of at least 1 year. Future long-term randomized controlled trials are needed to confirm our findings.
INTRODUCTION

Early staged glottic cancer can be successfully managed by either radiotherapy or endoscopic laser surgery, both providing high local control rates and long-term cure rates\(^1\)-\(^5\). Reports on voice outcome are generally less favorable and more contradictory concerning both treatment modalities. Recent studies on functional results describe a wide range of incidence of abnormal voice quality 14–92% after radiotherapy and 17–70% after laser surgery, respectively\(^6\)-\(^12\). Furthermore, studies on the influence of deteriorated voice on quality of life revealed that 27–58% of patients with voice problems experienced difficulties in communication leading to a disrupted social life\(^6\),\(^13\)-\(^22\). Evidently, a considerable number of patients treated for early glottic cancer have to deal with voice problems in daily life. Until recently, it was not clear whether these voice problems are amenable to voice therapy. Earlier research provided evidence of short-term efficacy of voice therapy in patients with voice problems after treatment of early glottic cancer\(^23\). In this randomized prospective study, immediate beneficial effect of voice therapy was not only found in the primary outcome measure, the Voice Handicap Index (VHI), but also in some of the other voice quality outcome measures (noise-to-harmonics ratio[NHR], jitter, and the perceptual rating of vocal fry)\(^23\). Outcome studies on efficacy of voice therapy in general are scarce and usually only report short-term effects. To the best of our knowledge, only three studies have reported on Long-term results of voice therapy involving patients treated for laryngeal cancer, and their results were contradictory\(^24\)-\(^26\). Fex and Henriksson\(^24\) applied voice therapy to reduce voice damage caused by radiotherapy for laryngeal cancer. In their study, 15 patients received voice treatment during radiation therapy. Unfortunately, the definition of normal voice quality in that study remained unclear, and a control group was lacking. Therefore, it is impossible to conclude that the voice results were a consequence of voice therapy. Zwirner et al.\(^25\) reported a positive acoustic effect of voice therapy in patients after laser surgery for T1–T3 laryngeal carcinomas. In this prospective study, 13 patients with substantial deterioration of voice function after laser surgery were subjected to an intensive voice rehabilitation program. After rehabilitation, the standard deviation of fundamental frequency and the NHR improved significantly but did not return to “normal” values as obtained from an age-and gender-matched control group. Sittel et al.\(^26\) could not demonstrate this beneficial effect of voice therapy after laser surgery for T1–T2 laryngeal carcinomas. On the contrary, they found that patients who did not receive voice therapy had considerable better voices than patients who did receive voice therapy. The patients after voice therapy showed a high percentage of ventricular fold phonation. According to the authors, this might have been because of lack of information and knowledge of the speech therapists, who may have assumed that phonation on glottic level was impossible after laser surgery.

The purpose of the present study is to determine whether the beneficial short-term effects of voice therapy in patients with voice problems after treatment of early glottic cancer as reported in our earlier study remain present on the long-term.
PATIENTS AND METHODS

Patients

During a period of 1 year, all patients visiting the head and neck oncology outpatient clinic for their regular follow-up after previous treatment with either radiotherapy or endoscopic laser surgery for early glottic cancer (Tis, T1N0M0, and T2N0M0 tumors; Tis: carcinoma in situ; T1: tumor limited to the vocal folds with normal mobility; T2: tumor expands supra- and/or subglottic, and/or impaired mobility; N0: no regional lymph node metastasis; M0: no distant metastasis, all according to the International Union Against Cancer staging system) at least 6 months before their visit had been screen regarding voice impairment. The screening instrument consisted of a validated and standardized 5-item 10-point anchored scaled questionnaire covering vocal abilities and social situations.27

Patients who, according to this questionnaire, showed voice impairment (score of 5 or less on at least one of the five items) had been asked to participate in a study on the efficacy of voice therapy. Those who were willing to participate had been divided, in order of appearance (random), into a voice therapy group (n = 12) or a control group (n = 11). Short-term results of this controlled study on efficacy of voice therapy have been reported earlier.23

The present pilot study focuses on the long-term results among the 12 patients in the voice therapy group. These patients were followed up for an average of 13 months (range, 6–20 months) after completion of the voice therapy. Their mean age, at the initial inclusion, was 58 years (range, 40–80). At the time of initial inclusion, the average time elapsed since the cancer treatment had been 31 months (range, 6–81). None of the 12 patients in the voice therapy group underwent any intervening medical or surgical treatment during the study period.

Radiotherapy

Patients treated with radiotherapy (n = 9) had been locally irradiated with the Varian CLIN-AC 2300, a linear 6 MV accelerator (Varian Medical Systems Inc., Palo Alto, CA). The total radiation was 57.5–60.0 Gy in case of T1a and T1b tumors (2.5 Gy per fraction, five times a week), whereas T2 tumors were generally irradiated with an accelerated schedule to a total dose of 70 Gy (2 Gy per fraction, six times a week). All T1 patients had been treated with two opposing lateral fields, generally, with a standard field size of 6 x 6 cm, using 6 MV photons. In case of a T2 tumor with supraglottic extension beyond the false cords and/or subglottic extension >1 cm, the radiation portals had been extended to levels II to IV on both sides and/or the paratracheal lymph node areas, respectively.
Endoscopic laser surgery

Patients treated with endoscopic laser surgery (n = 3) had been selected by means of videolaryngostroboscopic evaluation, using the presence of mucosal undulation as an indication for superficial tumor spread only. A Sharplan CO2 laser (with ACUspot micromanipulator; Sharplan Laser Industries, Tel Aviv, Israel) in a superpulse mode had been used for a chordectomy type II28.

Methods

Voice therapy

Patients were referred to a speech-language pathologist specialized in voice therapy (voice therapist) in their own neighborhood and treated with a maximum of 24 sessions; 30 minutes each, with a frequency of twice a week. The voice therapists informed about the patient’s medical history and videolaryngostroboscopic examination findings. The type of voice therapy could be freely chosen according to the patient’s needs and the therapists’ preference.

Voice analyses

All patients’ voices were examined three times: once at baseline (study entry assessment), once directly after finishing voice therapy (short-term assessment), and once after a longer period of time (follow-up assessment) at a moment that coincided with the normal follow-up in the head and neck oncology outpatient clinic. Multidimensional voice analysis (VHI questionnaire, acoustic and perceptual voice quality analysis, videolaryngostroboscopy, and voice range profile) was performed. As previously reported, the results of short-term efficacy proved to be good (p = 0.024) with a mean improvement of 15 points on the VHI (the main outcome measure)23. A beneficial short-term efficacy of voice therapy had also been found regarding the secondary voice quality outcome measures: NHR, jitter, and perceptual rating of vocal fry23.

To assess long-term efficacy of voice therapy, follow-up assessment was performed 6 months or more after finishing voice therapy. The follow-up voice assessment was restricted because of logistic reasons and included the VHI and acoustical voice analyses, which had shown the most distinct beneficial immediate effects of voice therapy23. The study period was defined as the time between short-term and follow-up assessment.

Voice Handicap Index

The VHI had been chosen as primary outcome measure. The VHI is a validated questionnaire measuring psychosocial handicapping effects of voice disorders29 and was translated and validated in Dutch30. The questionnaire consists of 30 statements on voice-related aspects in daily life (5-point rating scale), which can be divided in a functional, a physical, and an emotional subscale. The total score of the 30 questions ranges from 0 to 120. A higher score indicates a higher level of voice handicap (Appendix 2).
Acoustic Analyses.
Digital recordings of a sustained vowel /a/ at comfortable loudness and pitch were performed using the Computerized Speech Lab and Multidimensional Voice Program, developed by Kay Elemetrics (Pine Brook, NJ). A mouth-to-microphone distance of approximately 30 cm was held constant throughout all samples. Acoustic signal typing according to Behrman et al.31 revealed that all recordings were suitable for further acoustic analyses. Percent jitter, percent shimmer, and NHR were determined. The percentage of jitter represents the relative period-to-period variability. The percentage of shimmer represents the relative variability of the peak-to-peak amplitude. The NHR is an average ratio of energy of the inharmonic components in the range 1500–4500 Hz to the harmonic components energy in the analyzed signal.

Statistical analysis
The maintenance of the beneficial short-term efficacy of voice therapy in the long term was assessed by independent t tests on the mean voice analyses scores between short-term and follow-up assessments.

RESULTS
The mean time between short-term and follow-up assessments (study period) was 13 months (range, 6–20).

Voice Handicap Index
Table 1 shows the total VHI score per individual patient for the three different voice assessment periods (study entry, short-term, follow-up). The mean VHI scores improved significantly immediate after completion of voice therapy from 40 to 24 (t = 2.76, p = 0.013)23. During the study period, there was no additional significant change in VHI (t = 0.533, p =0.600), and the mean VHI score at follow-up assessment stayed significantly better as compared with the initial study entry assessment (t =.3.10, p = 0.006).

Acoustic analyses
Table 2 shows the mean scores of the acoustical parameters per voice assessment period. Immediately after completion of voice therapy, the acoustical parameters NHR (t = 3.142, p = 0.009), jitter (t = 2.513, p = 0.029), and shimmer (t = -2.653, p = 0.022) had improved significantly. During the study period, none of the acoustical parameters changed significantly with exception of the NHR, which (t = -4.185, p = 0.002)deteriorated. The mean values of the NHR and jitter at follow-up assessment showed no significant difference as compared with the initial study entry assessment (t = 1.307, p = 0.221 and t = 2.082, p = 0.064, respectively). However, the mean value of shimmer at follow-up assessment stayed significantly better as compared with the initial study entry assessment (t = 2.250, p = 0.048).
DISCUSSION

Our previous report already demonstrated the beneficial short-term effect of voice therapy in patients with voice problems after treatment of early glottic cancer. The present study provides initial evidence that this beneficial effect of voice therapy is not only just a short-lived voice improvement but also results in a better voice for a period of at least a year, and there is no reason to suspect a spontaneous voice deterioration after a longer period of time. The mean VHI score (the main outcome measure) improved from 40 at baseline to 24 post voice therapy and remained stable (score 22) after more than a year.

Recent studies revealed equivalence of various European translations and the original American VHI and confirmed the validity of a Dutch translation of the VHI in Dutch.

Table 1. Voice Handicap Index scores per assessment for each individual patient, and mean total scores (Standard deviation) per assessment

<table>
<thead>
<tr>
<th>N</th>
<th>Study entry</th>
<th>Short term</th>
<th>Follow up</th>
<th>Study-period (months)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>25</td>
<td>14</td>
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<td>2</td>
<td>61</td>
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<td>12</td>
<td>27</td>
<td>25</td>
<td>30</td>
<td>18</td>
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<tr>
<td>Mean Total</td>
<td>40 (16.17)</td>
<td>24 (10.26)</td>
<td>22 (11.19)</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 2. Mean values (Standard Deviation) for the acoustical parameters of the patients per assessment

<table>
<thead>
<tr>
<th></th>
<th>Study entry</th>
<th>Short term</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHR</td>
<td>.20 (.06)</td>
<td>.14 (.02)</td>
<td>.17 (.02)</td>
</tr>
<tr>
<td>Jitter</td>
<td>2.20 (1.50)</td>
<td>1.39 (1.32)</td>
<td>1.24 (1.03)</td>
</tr>
<tr>
<td>Shimmer</td>
<td>7.26 (3.20)</td>
<td>5.10 (1.12)</td>
<td>4.94 (2.95)</td>
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</table>
In the previous study, we confirmed that the VHI is an adequate tool for baseline and effectiveness measurement of voice problems in daily life. Regarding clinical relevant difference scores, a difference score of 10 points was found to be useful for individuals in clinical practice and 15 points to be useful in study group designs. Applied to the results of this former study, we see that immediately after completion of voice therapy in 7 of the 12 patients, the improvement on the VHI was clinically relevant with an amelioration of more than 10 points. Two of them even managed to obtain a VHI score well within the normal range (below 15) immediately after completion of voice therapy. Even more, another three patients showed further improvement into the VHI range of normal voices during the study period in the long term.

Findings in this study indicate that the beneficial short-term effect of voice therapy in patients who experience voice problems after treatment of early glottic cancer usually lasts in the long term and that even some time after completion of voice therapy further improvement can be found. Obviously, these results must be interpreted with some precaution, as a consequence of the relatively small number of patients included in the present study. Another point of concern is the low motivation rate noted during the initial inclusion phase of this study: almost 60% of the patients with self-reported voice problems after treatment for early glottic cancer did not feel the need for voice therapy and therefore did not participate. The patients presently included represent a group that was selected on grounds of positive motivation to follow a voice therapy program. The results may, therefore, be less favorable if patients are urged to enroll in a voice therapy program without the proper motivation. Future large-scaled studies are needed to assess long-term efficacy of voice therapy in patients treated for early glottic cancer.

CONCLUSION

The present study provides initial evidence that this beneficial effect of voice therapy is not just a short-lived voice improvement but results in a better voice for a period of at least 1 year.

Acknowledgments

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REFERENCES


