

Voice Range Profile and Health-related Quality of Life Measurements Following Voice Rehabilitation After Radiotherapy; a Randomized Controlled Study

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Summary: Purpose. The aim of the present study was to investigate the effects of voice rehabilitation in patients treated with radiotherapy for laryngeal cancer.

Method. A total of 42 patients with laryngeal cancer who are treated with radiotherapy with curative intent participated in a randomized controlled study. The collected data were voice range profiles (VRPs) and patient-reported outcome (PRO) instruments for measurement of self-perceived communication function (Swedish Self-Evaluation for Communication Experiences after Laryngeal cancer (S-SECEL)) and health related quality of life (HRQL) (European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Core 30/Head and Neck module). Data were collected 1 month (pre voice rehabilitation), 6 months, and 12 months postradiotherapy. Of the patients, 19 received voice rehabilitation, whereas 23 constituted a control group.

Results. There were several statistically significant improvements in the study group concerning the HRQL and self-perceived communication function. The largest improvements occurred between occasions 1 (prevoice rehabilitation) and 2 (6-month postradiotherapy) and then remained constant. VRP area demonstrated a statistically significant difference when comparing changes over time, where the study group improved more than the control group.

Conclusion. HRQL and self-perceived communication function showed improvement in the study group and trends of impairment in the control group. This result might suggest that it would be beneficial for the patients as well as in a health economic perspective, to receive voice rehabilitation to make a faster improvement of the HRQL and self-perceived communication function.

Key Words: Voice training–Speech therapy–Laryngeal neoplasms–Radiotherapy–Quality of life.

INTRODUCTION

Approximately 200 people are diagnosed with laryngeal cancer in Sweden annually.^{1,2}

Voice impairment is quite common after oncologic treatment. In a study by van Gogh et al, 40% of the patients experienced voice impairment up to 10 years after treatment for early glottic carcinoma.³ Additionally, Morgan et al found that the voices of all patients with laryngeal cancer were perceived as abnormal up to 10 years postradiotherapy.⁴ Because the patient's communication by speech is affected and everyday life is considerably influenced, there is a risk that the quality of life (QOL) decreases when the patient's voice changes.^{5–8} Moreover, hoarseness might have negative consequences on the ability to express personality and identity.^{5,9} For instance, Finizia et al, reported that 45% of the patients treated for laryngeal cancer were talking less up to 12 years after completion of radiotherapy.¹⁰ Even though change and deterioration of voice function occur, there are only a few small studies that have investigated the effect of voice rehabilitation for patients with laryngeal cancer.^{3,7,11,12} Studies by van Gogh et al showed beneficial effects of voice

rehabilitation on patients with early glottic carcinoma up to 1 year; however, these studies emphasized the need of further studies to confirm their findings.^{3,7} Voice range profile (VRP) is a method of measuring a person's voice range and has been used to measure changes of voice quality following voice therapy.^{13,14} It is an objective measure that can indicate improved or impaired voice function.¹⁵ To our knowledge, VRP has not been used in terms of measuring voice outcomes following voice therapy for this specific patient group. The aim of this study was to investigate the effects of voice rehabilitation in patients treated with radiotherapy for laryngeal cancer in terms of VRP, communicative function, and HRQL.

MATERIALS AND METHODS

Participants

The material is part of a larger randomized controlled study investigating the effects of voice rehabilitation after radiotherapy for laryngeal cancer. All patients in the western part of Sweden (Västra Götalandsregionen, VGR) were asked to participate via the weekly multidisciplinary cancer conference at the Otorhinolaryngology Clinic at the Sahlgrenska University Hospital between the years 2000 and 2011. The inclusion criterion was primary laryngeal cancer treated with radiotherapy with curative intent. Furthermore, the patients had to have sufficient knowledge of the Swedish language to independently fill in the questionnaires, as well as cognitive abilities to participate in the rehabilitation sessions. In the original study, 89 patients were included and randomized. The patients were eligible for analysis in the present study if VRPs were performed. VRP could

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TABLE 1.
Specification of the Voice Rehabilitation Sessions¹²

Session Number	Specification of the Session
1	Basic exercises: relaxation, posture, and breathing. Focus to find abdominal activity in breathing and unvoiced fricatives. Description of voice physiology. Starting with phonation.
2	Repetition of first session, phonation to a greater extent; voiced sounds and syllables.
3	Repeat basic exercises, expand with repeated syllables, short words. Begin generalization with short phrases.
4	Repeat and expand on session 3. Intonation and stressed syllables introduced.
5	Phonation with simultaneous physical movement. Longer phrases.
6	Repetition of most patient-relevant techniques. Focus on words and phrases of different lengths with resonance. Articulation exercises to find relaxed articulation.
7	Using learned techniques in reading of dialogs and conversation. Focus on appropriate pausing, eye contact.
8	Repetition of most patient-relevant techniques. Focus on volume and voice projection.
9	Repetition of most patient-relevant techniques.
10	Repetition of most patient-relevant techniques.

Notes: The sessions took place two times/week during the first 2 weeks, once a week during weeks 3–6, once every second week for the last two sessions, having a total of 10 sessions. Home exercises occurred after every session with a focus on the techniques taught.

only be performed at two of the four hospitals in the VGR. Therefore, this study presents the results of a subgroup of the randomized controlled study. All included patients were assessed regarding comorbidities at inclusion with the Adult Comorbidity Evaluation-27 (ACE-27).^{16,17}

Oncologic treatment

During the study period, radiotherapy was given as either conventionally fractionated or hyperfractionated accelerated. In all cases, the total radiation dose was 62.4–68 Gray (Gy) to the primary tumor, all according to the regional cancer treatment directives. The conventionally fractionated treatment was given with 2–2.4 Gy once daily to a total dose of 62.4–68 Gy, whereas the hyperfractionated-accelerated fractionation consisted of 1.7 Gy fractionations twice daily to a total dose of 64.6 Gy.

Design

Data were collected for all included patients at three different occasions: 1 month (baseline), 6 months, and 12 months postradiotherapy. Optimal allocation according to Pocock sequential randomization was performed by computerized randomization regarding age, smoking habits, tumor site, tumor size, and patients' self-evaluation of communication.¹⁸ The patients were randomized into equally sized groups; either a study group, who received voice rehabilitation, or a control group. Results from the original randomized controlled trial is presented elsewhere.^{19,20}

Intervention

The study group received 10 voice rehabilitation sessions with a speech-language pathologist (SLP) according to specified protocol (Table 1). Each session consisted of 30-minute voice rehabilitation and started approximately 1 month after completed oncologic treatment.

Voice range profile

VRPs were performed to measure the patients' voice range. The program used was Phonetograph 2.0 (Hitech Development AB, Sweden). A headset microphone (Sennheiser MKE 2-p, Sennheiser Nordic, Solna, Sweden) was placed 12 cm from the participant's mouth. The patients were instructed to phonate an /a/ in different frequencies and intensities during a period of 5 minutes to document the patients' maximum voice range (Figure 1). The VRPs are produced simultaneously to phonation, and the patient receives instant feedback of his or her voice production. The largest connected area in the VRP was measured. Moreover, the highest and the lowest frequency (F0) measured in Hertz (Hz) from the largest connected area of the VRPs, were documented for analysis as well as the highest and lowest intensity (decibel, dB).

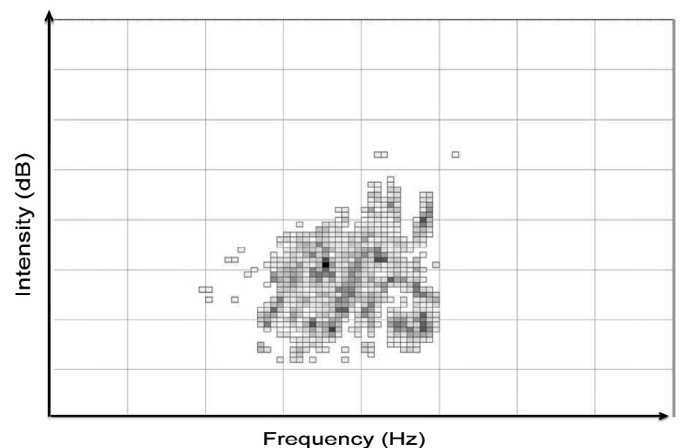


FIGURE 1. Voice range profile; frequency (Hz) on the x-axis, and intensity (dB) on the y-axis. Darker points indicate repetition of this particular frequency and intensity.

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