Supportive Care in Cancer (2019) 27:3537–3544
https://doi.org/10.1007/s00520-019-4647-1

ORIGINAL ARTICLE

Integrated rehabilitation after total laryngectomy: a pilot trial study

Ylenia Longobardi[1] · Vezio Savoia[2] · Francesco Bussu[3,4] · Luciana Morra[1] · Giorgia Mari[1] · Domenico A. Nesci[2] · Claudio Parrilla[1] · Lucia D'Alatri[1]

Received: 30 July 2018 / Accepted: 14 January 2019 / Published online: 26 January 2019

Abstract

Background Acquisition and acceptance of the alaryngeal voice, psychological state, and Quality of Life (QoL) of laryngectomized patients.

Methods Thirty-two patients who underwent total laryngectomy were included in the study; 17 of them were treated by a psychologist and a speech therapist (experimental group); 15 performed only speech therapy (control group).

Results The experimental group showed a significant improvement in all parameters of the INFVo scale, in the score of the Environment subscale and in the total score of the I-SECEL (Self-Evaluation of Communication Experiences after Laryngeal Cancer); in the Depression, Obsession-Compulsion and Paranoia areas of the SCL-90-R (Symptom Check List-90-Revised); and in the Social area (REL) of the WHOQOL-B (World Health Organization Quality of Life Scale–Brief).

Conclusions An integrated rehabilitative approach to laryngectomized patients improves emotional state and psychosocial aspects and promotes acceptance and use of the new voice and recovery of a better quality of life.

Keywords Total laryngectomy · Esophageal speech · Tracheoesophageal speech · Rehabilitation · Psycho-oncology

Introduction

Head and neck cancer is associated with issues related to the fear of illness and death, and with the disruption of self-image and social and family relationships.

The most common site for head and neck cancer in Italy is the larynx. In the last decades, management of laryngeal cancer changed and many conservative strategies, both surgical, with the codification of partial operations, and nonsurgical, with a variety of combinations and sequences of chemotherapy and radiotherapy, have been proposed and extensively spread in the clinical practice [1–5]. Such push for conservative treatment and consequent organ preservation in patients with laryngeal cancers has been dictated by the clear impairment of quality of life deriving from a total laryngectomy, which in spite of being pretty oncologically effective is a very mutilating procedure. Nevertheless, there is a growing body of literature showing that "organ preservation" therapies (surgical and nonsurgical) do not mean "function preservation," and to preserve a larynx or part of the larynx without tumor but with the need of permanent tracheotomy, feeding tube, and voice impairment is senseless and is related to poor quality of life. But some studies only consider laryngeal preservation as "larynx in place" without taking other data such as tracheotomy or the need for a feeding tube into consideration. The function of the larynx is often neglected [6–8]. Taking into account all these issues, total laryngectomy is still considered the gold standard for local control in advanced laryngeal cancer [9, 10].

Patients who undergo total laryngectomy face many problems as a direct consequence of the mutilating surgery such as the inability of voice production, alteration of the respiratory function, and the loss of smell and taste. Moreover, after total laryngectomy, the permanent tracheostoma determines a disfigurement of a visible part of the body which may have an extremely negative

✉ Claudio Parrilla
claudio.parrilla@policlinicogemelli.it

[1] Fondazione Policlinico Universitario A. Gemelli IRCCS – Università Cattolica del Sacro Cuore, Istituto di Otorinolaringoiatria, L.go F. Vito 1, I-00168 Rome, Italy

[2] Fondazione Policlinico Universitario A. Gemelli IRCCS, Unità di Consultazione Psichiatrica, L.go F. Vito 1, I-00168 Rome, Italy

[3] Otolaryngology Division, AOU Sassari, V.le San Pietro 43/B, I-07100 Sassari, Italy

[4] Università Cattolica del Sacro Cuore, Istituto di Otorinolaringoiatria, L.go F. Vito 1, I-00168 Rome, Italy

impact on the patient's body image and self-esteem. Therefore, the psychological trauma suffered by the laryngectomized patients may be more intense and significant than that experienced by patients with tumors in other areas [11, 12]. Indeed, a growing body of the literature shows that these patients would be more likely to express anxiety [13] and depressive symptoms [14], and would have a severely impaired Quality of Life (QoL) and a higher propensity to commit suicide than the general cancer population [15]. However, even if this issue is widely claimed, together with the importance of a psychological treatment, there are no reports in the literature that describe the psychological treatment in laryngectomized patients, as a complementary aspect of the voice rehabilitation.

Speech therapy after total laryngectomy may involve teaching of the esophageal voice, the setting up of the tracheoesophageal voice after placement of voice prosthesis, or training in the use of the electrolarynx. Over the last 30 years, surgical rehabilitation by voice prosthesis has become the gold standard counting a success rate ranging from 60 to 90% [16, 17]. After prosthesis placement, the patient, in a short span of time, may experience the production of a fluent alaryngeal voice whose perceived quality and acoustic parameters are better than those of the esophageal one [18, 19].

Despite the better quality of tracheoesophageal voice, changes and limitations in social interactions have been reported in patients with prostheses as well as in those with esophageal voice [20]. In fact, it would seem that there are no significant differences between tracheoesophageal (TE) and esophageal (E) speakers, both in the judgments expressed by the patient on the quality of his own voice [19] and the level of self-perceived vocal handicap [21].

Regardless of the degree of intelligibility, 40% of laryngectomized patients would tend to speak as little as possible, to leave things unsaid and to use the voice only if there are no other ways to communicate [22]. In a recent study, patients interviewed 8 years after laryngectomy still showed a moderate vocal self-perceived handicap, which influenced the judgment on the voice and the communicative function [21].

The aim of this study is to verify whether taking charge of the emotional and psychological needs of the laryngectomized patients, at an early setting and simultaneously to the speech therapy rehabilitation, may influence the acceptance the alaryngeal voice and the QoL of patients.

Materials and methods

Design

The study was a controlled clinical trial, comprising 32 individuals of both sexes who were allocated by randomization into two groups: the control group (C group) with 15 patients and the experimental group (E group) with 17 patients. Psychological disorders (SCL-90-R), subjective perception of well-being (WHOQOL-B), levels of adjustment to the new voice (I-SECEL), and speech parameters (intelligibility %, INFVo scale) were assessed before and after treatment.

Subjects

Between March 2015 and September 2017, 32 patients who underwent total laryngectomy (29 men and 3 women), with a mean age of 65.12 ± 6.53 years (range 54–80 years), were enrolled in the study.

Four out of 32 patients had been submitted to total laryngectomy as salvage (after radiotherapy), the other 28 as a primary procedure (previously untreated cases). Among the 28 patients treated primarily with a total laryngectomy, 17 had undergone adjuvant therapy (13 radiotherapy and 4 radiochemotherapy).

Twenty-four out of 32 patients were TE speakers. They received an indwelling low-resistance prosthesis (Provox Vega) (Atos Medical AB, Horby, Sweden) in 12 cases by a primary TE puncture and in 12 by a secondary one. Eight out of 32 were referred to rehabilitation in order to acquire the esophageal speech.

All the participants received pre- and post-operative speech pathologist counseling. All patients were Italian speakers; none of them had ever attended speech therapy. The only exclusion criterion used was the inability of the patient to attend the therapy sessions on a weekly basis. For this reason, patients living offsite were excluded, although they had been operated at the ENT Department of our Hospital.

Moreover, patients of both groups had oral intake with foods of all textures; they did not complain for weight loss and did not report social limitation due to swallowing disorders.

Immediately after hospital discharge, all patients were submitted to five individual sessions of speech therapy on a weekly basis to welcome them, to make them adapt to the therapeutic setting, and to ensure the first vocal emissions. At the end of this initial training, all the patients were able to produce the alaryngeal voice. Therefore, they were randomly assigned to two different therapeutic groups. Seventeen patients of the experimental 1 were treated simultaneously by a psychologist and a speech therapist, while 15 patients of the control 1 attended only speech therapy. All patients were treated in small group setting (from 3 to 6 individuals) differentiated according to the type of voice (TE voice or E voice).

The baseline assessment was performed after the five individual sessions of speech therapy, with post-therapy assessment immediately after the end of the group therapy.

All patients signed an informed consent. The study has been approved by the Medical Ethics Committee of the Catholic University of the Sacred Heart.

Data of the two groups of patients are summarized in Table 1.

Rehabilitation

All patients of the E group and of the C group performed 16 sessions of therapy. For patients of the experimental group, the rehabilitation activity was divided into 2 phases each of 8 sessions. During the first phase, a speech therapy program was proposed while the psychologist played a role as a participant observer. E speakers were instructed about techniques of esophageal air charge for the issuance of voice and TE speakers about proper cleaning and handling of the prosthesis and coordination among breathing, digital closing of the tracheostoma, and speech production. At the same time, the psychologist observed the relational dynamics within the group, with the aim of facilitating communication exchanges and the relationship among patients and between the patients and the speech therapist.

In the second phase, the psychologist, in the role of mediator and facilitator of communication exchanges, stimulated patients to address issues and experiences related to the illness. Particularly, psychological intervention was focused on the following: management of emotional reactions in response to the trauma of diagnosis and surgery; elaboration of mourning for the loss of the laryngeal voice; acceptance of the alaryngeal voice; processing of feelings like hostility, aggressiveness and guilt; and work aimed at improving self-esteem. In this phase, the speech therapy activities were more focused on communication and interpersonal skills as well as on exercises useful for the improvement of prosody.

The rehabilitation program for patients of the C group did not include any psychological support. For these patients, speech therapy activities were the same as that of the E group.

Assessment

For each patient, psychological distress (SCL-90-R), subjective perception of well-being (WHOQOL-B), levels of adjustment to the new voice (I-SECEL), perceptual evaluation of voice (INFV0), and assessment of intelligibility were assessed before and after treatment.

Perceptual evaluation of voice and assessment of intelligibility were carried out on voice samples recorded with a Shure model SM48 microphone (Evanston, IL, USA) positioned at an angle of 45° and at a distance of 20 cm from the patient's mouth. Voice recordings were directly stored in the host computer using the Computerized Speech Lab (CSL) Model 4500 (Kay Elemetrics, Lincoln Park, NJ). All recordings were made in a quiet room (ambient noise < 50 dB). Each recording was blindly listened and rated by two speech therapy students who did not have prior experience with or exposure to alaryngeal speech.

Intelligibility

The participants were asked to read aloud a list of 20 phonetically balanced bisyllabic words randomly selected among the ten available lists [23]. The two speech therapy students listened to the recorded voice samples in free field and transcribed the understood words. The intelligibility was defined as a mean percentage of correctly perceived words (intelligibility %) by the two listeners.

Table 1 Patients characteristics

	Experimental group ($N = 17$)	Control group ($N = 15$)
Mean age (years)	65.64 ± 5.83	64.53 ± 7.42
Neoadjuvant treatment	4/17	0/15
Adjuvant treatment	8/17	9/15
TE voice	12/17	12/15
E voice	5/17	3/15
Primary TE	5/12	7/12
Secondary TE	7/12	5/12
Average time from primary TEP to group taking charge (months)	2.16 ± 1.45	2.42 ± 1.27
Average time from LT and secondary TEP (months)	4.62 ± 2.83	4.56 ± 2.38
Average time from secondary TEP to group taking charge (weeks)	6.21 ± 1.83	5.83 ± 2.46
Average time from surgery to taking charge for E voices (months)	3.25 ± 1.85	3.01 ± 1.25

TE tracheoesophageal, *E* esophageal, *TEP* tracheoesophageal puncture

Perceptual assessment

The INFVo scale, a tool specifically designed for perceptual evaluation of substitution voices [24], whose reliability has also been proven in native Italian-speaking patients [25] was used. The scale examines the following parameters: overall impression (I), amount of unintended additive noise (N), fluency (F), and quality of voicing (Vo). For each parameter, the score can vary from 0 to 10. The higher the score, the better is the perceived voice quality. The participants were asked to read aloud a standard short passage, consisting of 5 sentences for a total of 100 syllables. The two raters listened and assessed the voice recordings. For each parameter of the INFVo scale, a mean score was calculated.

Self-Evaluation of Communication Experiences after Laryngeal Cancer

The Italian version of the "Self-Evaluation of Communication Experiences after Laryngeal Cancer" (I-SECEL) [26] is a self-report instrument that has been translated and validated by the original questionnaire published by Blood [27]. It measures the perceived adjustment to communication experiences and its aim is to determine if patients need specific counseling.

The I-SECEL includes 35 items, grouped according to 3 subscales labeled General, Environment, and Attitude. Patients have to rate each statement on a 4-point categorical scale (3 = always; 2 = often; 1 = sometimes; 0 = never). The total score can vary from 0 to 102. Subscores can also be obtained for the 3 subscales. A higher total score indicates greater perceived difficulty with adjustment to the new voice.

Symptom CheckList-90-Revised

The Symptom Check List-90-Revised (SCL-90-R) [28] is a self-report instrument, designed to measure various somatic and psychological signs of distress that have been standardized and validated in many languages including Italian [29]. SCL-90-R investigates ten areas: Somatization, Obsessive-Compulsiveness, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, Psychoticism, and Sleep Disorders.

The Check List consists of 90 items. Each item is rated on a 5-point Likert scale, from 0 ("not at all") to 4 ("very much"). For each area, an average score is calculated; a score equal to or greater than 1 is considered to be a pathological one.

World Health Organization Quality of Life Scale—Brief version

The World Health Organization Quality of Life Scale—Brief version [30], a short version of the WHO QOL-100 scale [31], is a 26-item self-administered questionnaire that has been validated across a wide variety of languages, including Italian [32]. It is a quality of life instrument which produces a profile with four domain scores: (1) Physical Health—PHY (7 items); (2) Psychological Health—PSY (6 items); (3) Social Relationships—REL (3 items); and (4) Environmental domain—ENV (8 items). Each item is scored in a Likert format from 1 to 5. The four domain scores are scaled in a positive direction with higher scores indicating a higher quality of life. The score of each domain is obtained by converting raw scores into transformed scores ranging from 0 to 100.

Statistic analysis

We used the statistical package MedCalc, version 12 (Marienkerke, Belgium). The Kolmogorov–Smirnov test was used to assess the distribution of the continuous variables examined in the study. The effect of group and time of therapy on the outcome variable (psychological distress, subjective perception of well-being, levels of adjustment to the new voice, phonatory parameters and intelligibility) was analyzed by means of a two-way analysis of variance (ANOVA). Bonferroni correction was applied for all analysis.

Two-by-two comparisons were obtained by means of Student's t test for independent data. Significance was set at $p < 0.05$.

Results

The Kolmogorov–Smirnov test showed the continuous distribution of the variables investigated in the study.

A Student's t test showed that the two groups of patients did not differ significantly by age ($p < 0.05$), nor by any average time from surgery to taking charge ($p < 0.05$).

Two-way ANOVA statistics was run, considering group (E group with psychological support vs C group without any psychological support) as between-subject factors and time of therapy (pre- vs post-treatment average scores) as within-subject factors.

Parameters of the INFVo scale and intelligibility

A significant effect of both groups and time factors on all parameters of the INFV0 scale was found ($p < 0.05$).

Degrees of freedom (DF), F and p values, mean score, and standard deviation of all parameters of the INFVo scale are available in Table 2.

Analysis of intelligibility results did not show any significant difference between the two groups ($p > 0.05$). This speech parameter was influenced only by time factor ($F(1, 60) = 16.15$, $p < 0.001$).

Table 2 INFVo scale: degrees of freedom (DF), *F* and *p* values, mean score, and standard deviation (DS) of all parameters

	DF	Group factor *F*	Group factor *p* value	Time of therapy factor *F*	Time of therapy factor *p* value	E group (*N* = 17)		C group (*N* = 15)	
						Pre-treatment Mean ± DS	Post-treatment Mean ± DS	Pre-treatment Mean ± DS	Post-treatment Mean ± DS
I	1–60	12.57	0.001	13.21	0.001	4.42 ± 0.46	7.61 ± 0.46	4.16 ± 0.49	4.86 ± 0.49
N	1–60	9.70	0.003	22.25	< 0.001	3.70 ± 0.50	7.14 ± 0.50	3.10 ± 0.53	4.53 ± 0.53
F	1–60	8.31	0.005	19.40	< 0.001	4.35 ± 2.11	7.73 ± 1.69	4.00 ± 2.12	5.13 ± 2.23
Vo	1–60	15.33	< 0.001	5.56	0.022	6.41 ± 0.46	7.79 ± 0.46	4.76 ± 0.49	5.66 ± 0.49

E experimental, *C* control, *I* overall impression, *N* amount of unintended additive noise, *F* fluency, *Vo* quality of voicing

Self-Evaluation of Communication Experiences after Laryngeal Cancer

Mean pre-therapy total scores of I-SECEL were 49.70 ± 11.01 for the E group and 45.8 ± 16.26 for the C group. After therapy, the mean total scores were respectively 22.88 ± 9.04 for the E group and 42.53 ± 15.06 for the C group. A significant effect of both groups ($F(1, 60) = 3.83$, $p = 0.04$) and time factors ($F(1, 60) = 17.32$, $p < 0.001$) on total scores of I-SECEL was found (Fig. 1).

Before treatment the mean scores of subscale E of I-SECEL were 23.70 ± 6.32 for the E group and 23.93 ± 3.37 for the C group. Post treatment, the mean values were 11.17 ± 5.57 for the E group and 19.73 ± 7.14 for the C group. As for total score of the I-SECEL, score of subscale E of the I-SECEL was influenced both by groups ($F(1, 60) = 7.06$, $p = 0.010$) and time factors ($F(1, 60) = 25.61$, $p < 0.001$).

Finally, no significant difference between the two groups was found for scores of subscales A and G ($p > 0.05$). These subscales were influenced only by the time factor (subscale A: $F(1, 60) = 4.09$, $p < 0.048$; subscale G: $F(1–60) = 4.63$, $p = 0.035$).

Symptom CheckList-90-Revised

A significant effect of only group factor on O-C, DEP, and PARA areas of SCL-90 was found ($p < 0.05$). Figure 2 shows results relative to the depression area.

Degrees of freedom (DF), *F* and *p* values, mean score, and standard deviation of O-C, DEP, and PARA areas of SCL-90 are available in Table 3.

No significant difference between the two groups was found for area ANX and HOS ($p > 0.05$). These areas were influenced only by time factors (area ANX: $F(1, 60) = 4.50$, $p < 0.038$; area HOS: $F(1–60) = 5.66$, $p = 0.021$).

For the other areas of the SCL-90-R, no significant improvement was found nor considering group factors and time factors ($p > 0.05$).

World Health Organization Quality of Life Scale—Brief version

Pre-treatment mean scores of REL domain were 45.58 ± 20.31 for the E group and 40.73 ± 24.70 for the C group. Post treatment, the mean scores of REL domain were respectively 57 ± 14.74 for the E group and 37.4 ± 19.75 for the C group. A

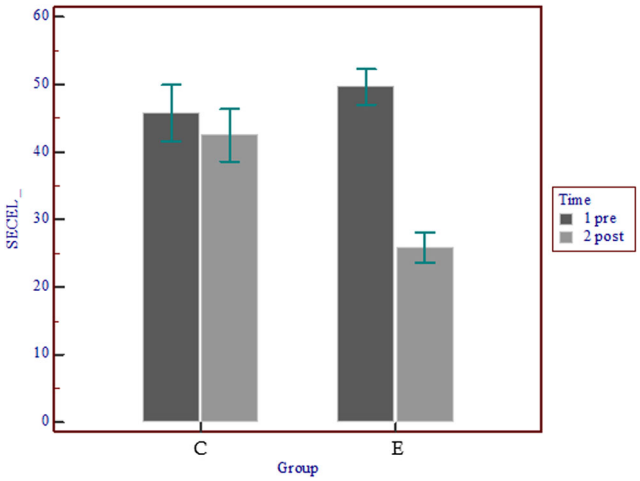

Fig. 1 I-SECEL: pre- and post-treatment mean total scores in the two groups of patients. C control, E experimental

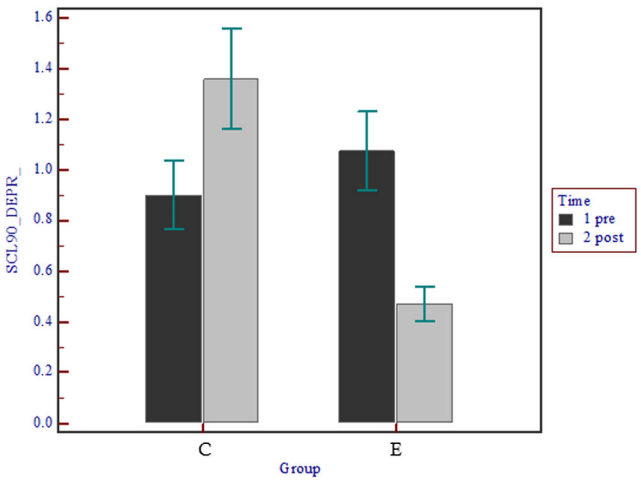

Fig. 2 SCL-90-R: pre- and post-treatment mean scores of the DEP area (Depression) in the two groups of patients. C control, E experimental

Table 3 SCL-90-R: degrees of freedom (DF), *F* and *p* values, mean score, and standard deviation (DS) of O-C, DEP, and PARA areas

	DF	Group factor *F*	Group factor *p* value	Time of therapy factor *F*	Time of therapy factor *p* value	E group (*N* = 17)		C group (*N* = 15)	
						Pre-treatment Mean ± DS	Post-treatment Mean ± DS	Pre-treatment Mean ± DS	Post-treatment Mean ± DS
O-C	1–60	6.53	0.013	Ns	Ns	0.76 ± 0.43	0.33 ± 0.32	0.85 ± 0.69	0.90 ± 0.54
DEP	1–60	6.06	0.017	Ns	Ns	1.07 ± 0.64	0.47 ± 0.27	0.90 ± 0.52	1.36 ± 0.77
PARA	1–60	4.50	0.038	Ns	Ns	0.84 ± 0.47	0.42 ± 0.49	0.94 ± 0.70	0.92 ± 0.66

E experimental, *C* control, *O-C* Obsessive-Compulsiveness, *DEP* Depression, *PARA* Paranoid ideation, *Ns* not significant

significant effect of only group factor ($F(1, 60) = 6.00$, $p = 0.017$) was found (Fig. 3).

No significant difference between the two groups was found for the PHY domain ($p > 0.05$). This domain was influenced only by time factors ($F(1, 60) = 9.16$, $p < 0.004$).

For the PSY and ENV domains, no significant improvement was found nor considering group factors and time factors ($p > 0.05$).

Discussion

The aim of this study was to verify if the integration of a psychological intervention with speech therapy can have a positive effect on emotional state, QoL, speech outcomes, and acceptance of alaryngeal voice in laryngectomized patients.

To this end, we have introduced 17 patients into small rehabilitation groups (from 3 to 6 individuals) where a psychological support and a reworking of the emotional issues related to the experience of illness were held in parallel with the speech therapy. Only one report in the literature showed a similar intervention model [33]. In that study, patients were placed into working groups led by a speech therapist, in which they had the opportunity to learn the esophageal voice and to share problems and difficulties related to the experience of illness. However, in that context, no evidence of a specific psychological treatment has been reported. Our working model, at the moment, represents the first attempt in the literature where groups of laryngectomized patients have been co-conducted by a psychologist and a speech therapist, assuming that voice and psychological therapy are both key points of the rehabilitation. The importance of a psychological intervention was motivated by the assumption that laryngectomized patients experience, more than other cancer patients, important levels of distress and that psychological care may be useful to strengthen the patient's coping capacity [34, 35].

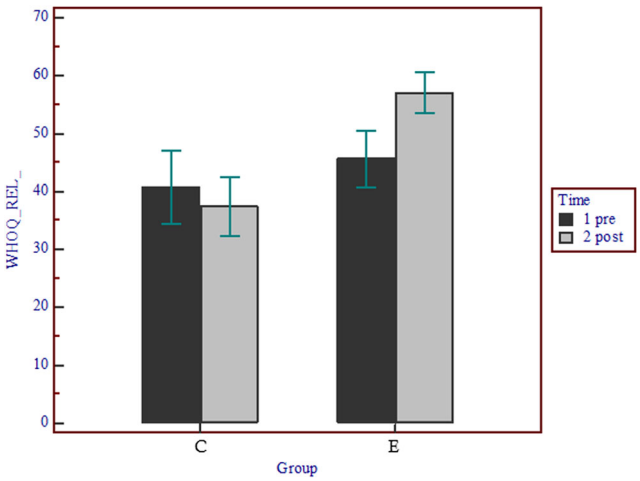

Fig. 3 WHOQOL-B: pre- and post-treatment mean scores of the REL domain (Social relationships) in the two groups of patients. C control, E experimental

In the present study, patients were randomly placed in two different therapy groups, in only one of them speech therapy was performed simultaneously with psychological support. Because the aim of this study was to verify the importance of a combined rehabilitative approach in the laryngectomized patient "tout court," we purposefully neglected the difference between esophageal and tracheoesophageal patients and between irradiated versus non-irradiated patients that could be topics of further studies.

After treatment, group E showed a significant improvement with respect to group C in all parameters of the INFVo scale, in the score of the Environment subscale and in the total score of the I-SECEL, in the Depression, Obsession-Compulsion, and Paranoia areas of the SCL-90-R and in the Social area (REL) of the WHOQOL-B.

Specifically, the most significant results, from a psychological and clinical point of view, concerned the reduction of depression. In fact in the E group, depression went from an average score greater than 1 (pathological cutoff) to one less than 1 while the C group had an opposite behavior.

Losing voice after total laryngectomy does not mean only to miss the ability to transmit a message through the verbal channel. In social interactions, the voice is an important indicator of identity, personality, and mood. Laryngectomized patients often experience difficulties in conveying, through the vicarious voice, the effective meaning of what they want to express since the acoustic features that transmit the emotions

are deeply altered [36, 37]. The improvement of speech parameters and of the alaryngeal voice acceptance, measured with I-SECEL, translated into patient's daily life with greater trust in his/her voice (i.e., telephone use, use of voice in noisy environments and with distant interlocutors) and with a greater propensity to use it in various social contexts, with a consequent reduction of isolation. These data were also confirmed by the significant improvement in the social domain of WHOQOL-B and in the Environment subscale of I-SECEL.

Regarding patient communication experiences, it is also interesting to note that intelligibility alone is not sufficient to explain the patient's adjustment to the new voice. In fact, despite similar levels of intelligibility, the two groups showed significantly different levels of adaptation. This finding, in addition to suggest that psychological support may facilitate the integration of the new voice into patient's self-image, confirms that a good intelligibility may not correspond to patient's good judgment about his outcome [38, 39].

Based on our findings, we believe that the integration of psychological and voice treatments facilitates on one side the elaboration of the experience of illness and the containment of anxiety, and on the other side may have improved the learning of new voice. In our hypothesis, the work of the two therapists as mediators and facilitators of communication exchanges has allowed the identification among members and it has stimulated the mutual support. This has also allowed the patients to gradually reduce the psychological distress. It could be interesting to evaluate in a future long-term follow-up study if our results are long-lasting or not.

We cannot rule out, also, that the work of sharing carried out in the experimental group may have facilitated learning and acceptance of voice by encouraging patients in need. Moreover, the improvement of the depressive state could have had beneficial effects both on the voice acceptance and on the patients' social relationships. Indeed, a previous study already demonstrated that, among the symptoms of psychological distress, depression is the one that has the strongest correlation with the majority of QOL domains [40].

Conclusion

An integrated rehabilitation to laryngectomized patients allows the psychological support to act directly on emotional distress and psychosocial aspects and the speech therapy to work on aspects relating to voice. Through speech therapy, the patient learns to produce the alaryngeal voice; nevertheless, speech therapy alone may not be sufficient to allow the patient to accept the new communication method, to recover the emotional well-being, and to get a better QoL. Psychological needs should be addressed in all patients who have received laryngectomy and incorporated into their treatment plans.

Compliance with ethical standards All patients signed an informed consent. The study has been approved by the Medical Ethics Committee of the Catholic University of the Sacred Heart.

Conflict of interest The authors declare that they have no conflicts of interest.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

1. Forastiere AA, Goepfert H, Maor M, Pajak TF, Weber R, Morrison W, Glisson B, Trotti A, Ridge JA, Chao C, Peters G, Lee DJ, Leaf A, Ensley J, Cooper J (2003) Concurrent chemotherapy and radiotherapy for organ preservation in advanced laryngeal cancer. N Engl J Med 349:2091–2098
2. Bussu F, Almadori G, De Corso E et al (2009) Endoscopic horizontal partial laryngectomy by CO(2) laser in the management of supraglottic squamous cell carcinoma. Head Neck 31:1196–1206
3. Dinapoli N, Parrilla C, Galli J, Autorino R, Miccichè F, Bussu F, Balducci M, D'Alatri L, Marchese R, Rigante M, di Lella G, Liberati L, Almadori G, Paludetti G, Valentini V (2010) Multidisciplinary approach in the treatment of T1 glottic cancer. The role of patient preference in a homogenous patient population. Strahlenther Onkol 186:607–613
4. Bussu F, Micciche F, Rigante M et al (2012) Oncologic outcomes in advanced laryngeal squamous cell carcinomas treated with different modalities in a single institution: a retrospective analysis of 65 cases. Head Neck 34:573–579
5. Bussu F, Paludetti G, Almadori G, de Virgilio A, Galli J, Miccichè F, Tombolini M, Rizzo D, Gallo A, Giglia V, Greco A, Valentini V, de Vincentiis M (2013) Comparison of total laryngectomy with surgical (cricohyoidopexy) and nonsurgical organ-preservation modalities in advanced laryngeal squamous cell carcinomas: a multicenter retrospective analysis. Head Neck 35:554–561
6. Jenckel F, Knecht R (2013) State of the art in the treatment of laryngeal cancer. Anticancer Res 33:4701–4710
7. Bindewald J, Herrmann E, Dietz A, Wulke C, Meister E, Wollbrück D, Singer S (2007) Quality of life and voice intelligibility in laryngeal cancer patients–relevance of the "satisfaction paradox". Laryngorhinootologie 86:426–430
8. Chawla S, Carney AS (2009) Organ preservation surgery for laryngeal cancer. Head Neck Oncol 1:12
9. Hoffman HT, Porter K, Karnell LH, Cooper JS, Weber RS, Langer CJ, Ang KK, Gay G, Stewart A, Robinson RA (2006) Laryngeal cancer in the United States: changes in demographics, patterns of care, and survival. Laryngoscope 116:1–13
10. Richard JM, Sancho-Garnier H, Pessey JJ, Luboinski B, Lefebvre JL, Dehesdin D, Stromboni-Luboinski M, Hill C (1998) Randomized trial of induction chemotherapy in larynx carcinoma. Oral Oncol 34:224–228
11. Danker H, Wollbrück D, Singer S et al (2010) Social withdrawal after laryngectomy. Head Neck 267:593–600
12. Singer S, Krauss O, Keszte J et al (2011) Predictors of emotional distress in patients with head and neck cancer. Head Neck 34:180–187
13. Almonacid CI, Ramos AJ, Rodriguez-Borego MA (2016) Level of anxiety versus self-care in the preoperative and postoperative periods of total laryngectomy patients. Rev Lat Am Enfermagem 24: e2707

14. Yılmaz M, Yener M, Yollu U, Akil F, Haciyev Y, Yargic I, Karaman E, Cansiz H (2015) Depression, self-esteem and sexual function in laryngeal cancer patients. Clin Otolaryngol 40:349–354
15. Misono S, Weiss NS, Fann JR et al (2008) Incidence of suicide in persons with cancer. J Clin Oncol 29:4731–4738
16. Serra A, Di Mauro P, Spataro D et al (2015) Post-laryngectomy voice rehabilitation with voice prosthesis: 15 years experience of the ENT Clinic of University of Catania. Retrospective data analysis and literature review. Acta Otorhinolaryngol Ital 35:412–419
17. Macri GF, Bogaartd H, Parrilla C et al (2013) Patients' experiences with HMEs and attachments after total laryngectomy. Head Neck 35:1583–1590
18. Singer S, Wollbruck D, Dietz A et al (2013) Speech rehabilitation during the first year after total laryngectomy. Head Neck 35:1583–1590
19. Parrilla C, Minni A, Bogaartd H et al (2015) Pulmonary rehabilitation after total laryngectomy: a multicenter time-series clinical trial evaluating the Provox XtraHME in HME-Naive patients. Ann Otol Rhinol Laryngol 124:706–713
20. Doyle PC, Keith RL (2005) Contemporary considerations in the treatment and rehabilitation of head and neck cancer: voice, speech and swallowing. Pro-ed., Austin, pp 76–77
21. Eadie TL, Otero D, Cox S et al (2016) The relationship between communicative participation and postlaryngectomy speech outcomes. Head Neck 38:955–961
22. Danker H, Wollbruk D, Singer S et al (2010) Social withdrawal after laryngectomy. Eur Arch Otorhinolaryngol 267:593–600
23. Turrini M, Cutugno F, Maturi P et al (1993) Bisyllabic words for speech audiometry: a new Italian material. Acta Otorhinolaryngol Ital 13:63–77
24. Moerman M, Martens JP, Crevier-Buchman L, Haan E, Grand S, Tessier C, Woisard V, Dejonckere P (2006) The INFVo perceptual rating scale for substitution voicing: development and reliability. Eur Arch Otorhinolaryngol 263:435–439
25. Schindler A, Ginocchio D, Atac M et al (2013) Reliability of the Italian INFVo scale and correlations with objective measures and VHI scores. Acta Otorhinolaryngol Ital 33:121–127
26. Schindler A, Mozzanica F, Brignoli F, Maruzzi P, Evitts P, Ottaviani F (2013) Reliability and validity of the Italian self-evaluation of communication experiences after laryngeal cancer questionnaire. Head Neck 35:1606–1615
27. Blood GW (1993) Development and assessment of a scale addressing communication needs of patients with laryngectomies. Am J Speech Lang Pathol 2:82–90
28. Derogatis LR (1994) Symptom check list-90-R: administration, scoring and procedures manual, Third edn. National computer systems, Minneapolis
29. Sarno L, Preti E, Prunas A et al (2011) SCL-90-R Symptom Checklist-90-R Adattamento Italiano. Giunti Organizzazioni Speciali, Firenze
30. WHOQOL Group (1998) Development of the World Health Organization WHOQOL-BREF quality of life assessment. Psychol Med 28:551–558
31. The WHOQOL Group (1994) The development of the World Health Organization Quality Of Life assessment instrument (the WHOQOL). In: Orley J, Kuyken W (eds) Quality of life assessment: international perspective. Springer Verlag, Heidelberg, pp 41–57
32. DeGirolamo G, Rucci P, Scocco A et al (2000) La valutazione della Qualità della Vita: validazione del WHOQOL-breve. Epidemiol Psichiatr Soc 9:45–55
33. Hirani I, Siddiqui AH, Muhammad Khyani IA (2015) Apprehensions and problems after laryngectomy: patients' perspective. J Pak Med Assoc 65:1214–1218
34. Keszte J, Danker H, Dietz A, Meister E, Pabst F, Vogel HJ, Meyer A, Singer S (2013) Mental disorders and psychosocial support during the first year after total laryngectomy: a prospective cohort study. Clin Otolaryngol 38:494–501
35. Maclean J, Cotton S, Perry A (2009) Dysphagia following a total laryngectomy: the effect on quality of life, functioning, and psychological well-being. Dysphagia 24:314–321
36. Laver J (1980) The phonetic description of voice quality. Cambridge University Press, Cambridge
37. Bickford J, Coveney J, Baker J, Hersh D (2013) Living with the altered self: a qualitative study of life after total laryngectomy. Int J Speech Lang Pathol 15:324–333
38. D'Alatri L, Bussu F, Scarano E, Paludetti G, Marchese MR (2012) Objective and subjective assessment of tracheoesophageal prosthesis voice outcome. J Voice 26:607–613
39. Eadie TL, Day AM, Sawin DE et al (2013) Auditory-perceptual speech outcomes and quality of life after total laryngectomy. Otolaryngol Head Neck Surg 148:82–88
40. Perry A, Casey E, Cotton S (2015) Quality of life after total laryngectomy: functioning psychological well-being and self-efficacy. Int J Lang Commun Disord 50:467–475