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CRITERIA OF QUALITY OF LIFE FOR ASSESSING THE EFFECTIVENESS OF SPEECH REHABILITATION OF PATIENTS AFTER HEMIGLOSSECTOMY

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The quality of life (QOL) of patients after radical surgery for oral cavity and oropharyngeal cancer is an important factor in determining the treatment effectiveness. Restoring functional and social capabilities, particularly speech and nutrition, is a crucial aspect of rehabilitation. **The purpose of the study** was to assess QOL of patients as one of the criteria for evaluating the effectiveness of speech rehabilitation technique using the OnkoSpeech v4.0 computer software. **Materials and methods**. The study included 140 patients with stage II–IV oral cavity and oropharyngeal cancer, who underwent hemiglossectomy (resection of ½ of the tongue). The median age of the patients was 54 years (range, 34 to 70 years, IQR-26). All patients were divided into two groups. Group I consisted of 70 patients who underwent speech restoration using the computer-software complex (OnkoSpeech v4.0 computer software). Group II comprised 70 patients who used the standard technique for speech restoration. To assess QOL, the EORTC QLQ-30 (version 3.0) and QLQ-H&N35 questionnaires were used. The assessment was carried before starting combination treatment, before starting rehabilitation, after completing rehabilitation, and 6 and 12 months after competing rehabilitation. **Results.** The analysis of data revealed significant differences in the parameters of speech restoration and quality of life between the groups. Group I (OnkoSpeech v4.0) patients demonstrated a statistically significant improvement in these parameters compared to group II patients ($p<0.05$). The EORTC QLQ-C30 scales did not show a statistically significant difference in the values of the functional scales (physical, role and social functioning) between the groups. According to the QLQ-H&N35 data, group I patients experienced less severe symptoms associated with speech, swallowing and social communication compared to group II patients. The standard technique (Group II) showed a slower recovery and less severity of positive dynamics. **Conclusion.** The use of OnkoSpeech v4.0 demonstrated higher efficiency of speech rehabilitation and improvement of patients' quality of life compared to the standard technique. The data obtained highlight the potential of integrating digital technologies into speech rehabilitation of cancer patients, which can be recommended for further implementation in clinical practice.

Key words: surgical treatment; functional disorders; speech rehabilitation; quality of life; computer software complex "OnkoSpeech v4.0".

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Introduction. Rehabilitation of patients after combination treatment for cancer is essential and growing trend in cancer care [1,6]. Evaluation of the effectiveness of rehabilitation techniques using the QOL criterion provides a deeper and more comprehensive understanding of their significance for patients [2,3,5]. The QOL assessment incorporates subjective patient-reported psychological, social, and functional aspects alongside objective clinical data to evaluate a rehabilitation technique's overall impact [4,7]. Comparison of QOL before and after using a new rehabilitation technology provides objective evidence of its effectiveness, allowing for a comparison with current methods. This approach helps ensure that patients receive the most suitable and effective treatments by evaluating how a new technology impacts their well-being [6,8].

The purpose of the study was to assess patients' QOL as one of the criteria

for evaluating the effectiveness of speech rehabilitation technique using the computer-software complex (OnkoSpeech v4.0 computer software).

Materials and methods. The prospective study included 140 patients with stage T1–T4N0–N2M0 oral cavity and oropharyngeal cancer, who were treated at the Department of Head and Neck Tumors of the Cancer Research Institute from 2004 to 2022. The median age of the patients was 54 years (range, 34 to 70 years, IQR-26). The patients underwent hemiglossectomy (resection of ½ of the tongue) without capturing the root and excision of the floor of the mouth muscles on the affected side. Lymph node dissection of the neck (right/left, on both sides) was performed if indicated. In the postoperative period, all patients had a speech disorder characterized by difficulty with pronunciation and speech prosody, along with swallowing problems. All patients were divided into two groups. Group I consisted of 70 patients who underwent speech rehabilitation using the computer-software complex (OnkoSpeech v4.0 computer software) for acoustic analysis of speech signals. Group II included 70 patients who used the standard technique for speech restoration (fig.1).

The European Organization for Research and Treatment of Cancer (EORTC) QLQ-30 questionnaire (version 3.0) was used to assess patients' QOL, which was found to be reliable and valid for cancer patients. This allowed for a detailed assessment using 5 functional scales, 3 symptom scales, general health status, and 6 individual questions.

Special tools can identify changes typical for patients diagnosed with oral cavity and oropharyngeal cancer. In our opinion, the QLQ-H&N35 questionnaire, specially designed for patients with head and neck tumors, is the most effective for this category of patients. It assesses the severity of problems and symptoms that most often occur in these patients. The questionnaire contains 7 scales assessing pain, swallowing, sensations (taste and smell), language, diet, social contacts, sexuality and 11 separate questions.

The characteristics influencing patients' QOL were compared during speech therapy and 6 and 12 months after speech therapy. The QOL assessment scale has a range from 0 to 100 points. According to the EORTC QLQ-30 protocol (version 3.0), a higher score means a higher (improved) functional level and QOL (general health status). According to the EORTC QLQ-H&N35 protocol for symptomatic scales and individual questions, a higher score indicates a high (worse) level of symptoms. The QOL study was conducted at five control points: before starting combination treatment, after diagnosis confirmation, after surgical treatment at the beginning of speech therapy, after completion of speech therapy, and 6 and 12 months following speech therapy.

Statistical analysis was performed according to the EORTC protocols, with data entered into the Statistica 9.0 and SPSS 25 software to calculate results as medians and interquartile ranges. Interquartile range (IQR) defined as the dif-

Table 1

The EORTC QLQ-30 questionnaire (version 3.0). Dynamics of patients' quality of life indicators according to functional scales (from 0 to 100 point scale)

Functional scales of EORTC QLQ-30 (version 3.0) questionnaire / Study phases		**Group I** (n – 70) Speech rehabilitation using OnkoSpeech v4.0 computer software	**Group II** (n – 70) Speech rehabilitation using the standard technique
Physical functioning PF2	Before starting combination treatment	78.3 (63-100)	81.1(66 -100)
	Before starting speech rehabilitation	55.6 (43-66)	57.9(40-66)
	After completing speech rehabilitation	61.2 (46-76)	64.2(46-83)
	6 months after speech rehabilitation	69.6 (56-100)	72.1(60-100)
	12 months after speech rehabilitation	74.6 (56-100)	72.6(60-100)
Role functioning RF2	Before starting combination treatment	44.2 (0-64)	76.4(67-100)
	Before starting speech rehabilitation	61.5 (50-67)	41.5(17-67)
	After completing speech rehabilitation	63.6 (34-87)*	48.1(33-67)
	6 months after speech rehabilitation	65.2 (50-100)	58.3(50-83)
	12 months after speech rehabilitation	70.1 (50-100)	62.2 (50-83)#
Emotional functioning EF	Before starting combination treatment	44.2 (0-64)	36.2 (23-50)
	Before starting speech rehabilitation	61.5 (50-67)	66.1(50-83)
	After completing speech rehabilitation	63.6 (34-87)*	71.2 (34-100)*
	6 months after speech rehabilitation	65.2 (50-100)	69.8 (50-100)
	12 months after speech rehabilitation	70.1 (50-100)	71.9 (50-100)
Social Functioning SF	Before starting combination treatment	81.4 (50-100)	72.6(67-100)
	Before starting speech rehabilitation	36.1 (17-50)	38.5 (17-50)
	After completing speech rehabilitation	45.6 (17-67)	49.3 (17-67)
	6 months after speech rehabilitation	69.6 (50-83)	64.6 (50-83)
	12 months after speech rehabilitation	71.1 (50-100)#	67.6 (50-87)#

Note. In table 1-3: M – arithmetic mean; n – number of subjects; the sample range, minimum and maximum, respectively, are indicated in parentheses; * - values have statistically significant differences between groups ($p<0.05$); # – statistically significant difference in indicators at the third (after RR) and fifth (12 months after RR) stages of the study.

ference between the third (Q3) and first (Q1) quartiles, was used to assess the data variability. Differences were considered statistically significant at a p value less than 0.05.

Results. Almost all functional scales (PF2, RF2, SF) and the general health status (QOL) were found to show similar changes over time, except for the emotional functioning scale (EF) (Table 1, 2). In the postoperative period, the mean score and median statistically decreased, indicating a significant deterioration in physical, role and social functioning. After completing speech rehabilitation, as well as 6 and 12 months after speech rehabilitation completion, the indicators were improved. These results highlight that physical rehabilitation depends primarily on the patient's general health status rather than on the speech rehabilitation technique. The decrease in the standard deviation indicates a decrease in variability in the results, which indicates a homogeneous improvement dynamics in both study groups. In our study, there were patients who showed complete recovery according to the scales (PF2, RF2, SF) (100 points) 6 and 12 months after speech rehabilitation. Group I patients had better results in restoring social contacts. This may also indicate that speech rehabilitation using OnkoSpeech v4.0 contributes to better patient involvement in social life. Group I showed an improvement in the overall health status (QOL), especially 12 months after speech rehabilitation (Table 2). The difference between the groups was 6.9 points, which was statistically significant ($p<0.05$).

The scores on the emotional functioning (EF) scale in both study groups at the first control point were the lowest over the entire observation period, subsequently tended to increase. The decrease in the standard deviation indicates a decrease in variability in the results (Table 2).

Statistically significant differences in symptom scales for problems with speech (HNSP), social contacts (HNSC), social eating/nutrition (HNSO), and swallowing (HNSW) were found between the study groups. Group I patients had better outcomes in reducing theses problems compared to group II patients, thus confirming the high efficacy of OnkoSpeech v4.0 computer-software (Table 3).

Discussion. Postoperative speech rehabilitation for oral and oropharyngeal cancer patients was shown to lead to statistically significant improvements in functional and symptomatic indicators. Functional scales, such as PF2 (physical functioning), RF2 (role functioning), SF (social functioning), as well as the general health status (QOL), showed positive outcomes after the completion of speech rehabilitation in both patient groups.

Table 2

The EORTC QLQ-30 questionnaire (version 3.0). Dynamics of QOL (general health status) indicators of patients on a 0 -to -100 scale

Study phases	**Group I** (n – 70) Speech rehabilitation using OnkoSpeech v4.0 computer software	**Group II** (n – 70) Speech rehabilitation using the standard technique
Before starting combination treatment	64.1 (33-100)	62.6 (33-100)
Before starting speech rehabilitation	39.4 (25-50)	38.5 (16-50)
After completing speech rehabilitation	52.2 (41.5-75)	55.1 (41.5-75)
6 months after speech rehabilitation	59.4 (41.5-75)	61.3 (41.5-75)
12 months after speech rehabilitation	67.5(50-83) #	60.6 (50-83) *#

However, an important point is that the dynamics of the emotional functioning scale (EF) indicators differs from other functional scale indicators. The lowest scores were recorded at the phase before starting combination treatment. Receiving a cancer diagnosis and expecting surgery significantly worsens patients' emotional state in both patient groups. At the phase of speech rehabilitation, a tendency towards improvement was observed, which was confirmed by a decrease in the standard deviation and an increase in the average values on this scale. This may indicate that emotional recovery is closely related to physical and social well-being, and successful speech rehabilitation contributes to the improvement of psycho-emotional state of the patient. A decrease in variability in the results of the emotional functioning scale may also indicate the effectiveness of speech rehabilitation techniques in both groups.

In both patient groups, gradual functional improvements in physical, role, and social areas were observed immediately after speech rehabilitation completion and continued to improve over the following 6 and 12 months. Both patient groups showed a gradual recovery in physical, role, and social functioning from the completion of speech rehabilitation until 6 and 12 months following therapy. The decrease in the standard deviation in both groups indicated a more homogeneous improvement over time, which confirmed the stabilization of recovery outcomes among patients who underwent speech rehabilitation.

Particular attention should be paid to the improvement of social functioning in Group I, where OnkoSpeech v4.0 computer software was used for speech rehabilitation. This indicates the prospect of using digital technologies in speech rehabilitation, which actively involve patients in social life, which is especially important for improving their QOL in the postoperative period.

Computer-based speech rehabilitation technique (OnkoSpeech v4.0) demonstrated its effectiveness, showing clear advantages in various symptomatic scales. The indicators obtained on scales related to speech (HNSP), social contacts (HNSC), nutrition (HNSO) and swallowing (HNSW) confirmed that the use of this digital technique provided better results in reducing these problems compared to speech rehabilitation techniques without the use of digital technologies. This emphasizes the high efficiency of innovative technologies that can significantly accelerate the restoration of patients' speech, improving their quality of life and reducing postoperative symptoms, such as speech and swallowing problems.

Conclusion. Speech rehabilitation following oral and oropharyngeal cancer surgery has a significant impact on the restoration of functional indicators, including physical, role and social functioning, as well as general health status.

It is important to consider that emotional functioning requires special attention. It can be significantly improved during speech rehabilitation, which is confirmed by changes in scores on the EF scale.

Digital technologies, such as the OnkoSpeech v4.0 computer software, play an important role in successful speech rehabilitation, providing a better effect in

Table 3

The QLQ-H&N35 questionnaire. Dynamics of patients' quality of life indicators using a 0-to-100 scale

Symptom scales of the QLQ-H&N35 questionnaire / Study phases		**Group I** (n – 70) Speech rehabilitation using OnkoSpeech v4.0 computer software	**Group II** (n – 70) Speech rehabilitation using the standard technique
Problems related to eating (HNSO)	Before starting combination treatment	12.1(0-22)	8.9(0-27)
	Before starting speech rehabilitation	54.9(17-100)	63.9(13-100)
	After completing speech rehabilitation	33.4(0-46) #	41.2(0-50)*#
	6 months after speech rehabilitation	21.9 (0-27)	27.4(0-25)*
	12 months after speech rehabilitation	15.7(0-22) #	17.9 (0-22)#
Problems related to speech (HNSP)	Before starting combination treatment	10.1 (0-33)	7.9(0-33)
	Before starting speech rehabilitation	54.2 (33-100)	55.1 (33-100)
	After completing speech rehabilitation	31.6 (17-50)#	34.5(17-66)#
	6 months after speech rehabilitation	20.4 (0-50)	24.1 (0-50)*
	12 months after speech rehabilitation	16.4(0-43)#	18.0(0-50)*#
Problems related to social contacts (HNSC)	Before starting combination treatment	6.8(0-33)	6.5(0-33)
	Before starting speech rehabilitation	68.9(50-100)	65.9(50-100)
	After completing speech rehabilitation	31.4(33-50)#	33.7(33-50)#
	6 months after speech rehabilitation	23.5 (0-50)	26.8(0-50)*
	12 months after speech rehabilitation	19.8 (0-50)#	22.1 (0-50) #
Swallowing problems (HNSW)	Before starting combination treatment	14.3 (0-23.5)	19.3(0-25)
	Before starting speech rehabilitation	64.8(10-83)	63.1 (9-87)
	After completing speech rehabilitation	23.2(0-46)	21.6(0-46)#
	6 months after speech rehabilitation	12.6 (0-25)	10.5 (0-25)
	12 months after speech rehabilitation	9.6 (0-22)	8.9 (0-22)

eliminating problems related to speech, social contacts, nutrition and swallowing. The use of these technologies opens up new prospects for improving patients' long-term QOL.

Thus, the integration of digital technologies into the speech rehabilitation of patients who have undergone surgery for oral cavity and oropharyngeal cancer holds significant potential to improve functional and symptomatic outcomes, and may become a key component of successful speech restoration.

The authors declare no conflict of interest.

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