

Speech therapy after thyroidectomy

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Abstract: Common complaints of patients who have received thyroidectomy include dysphonia (voice dysfunction) and dysphagia (difficulty swallowing). One cause of these surgical outcomes is recurrent laryngeal nerve paralysis. Many studies have discussed the effectiveness of speech therapy (e.g., voice therapy and dysphagia therapy) for improving dysphonia and dysphagia, but not specifically in patients who have received thyroidectomy. Therefore, the aim of this paper was to discuss issues regarding speech therapy such as voice therapy and dysphagia for patients after thyroidectomy. Another aim was to review the literature on speech therapy for patients with recurrent laryngeal nerve paralysis after thyroidectomy. Databases used for the literature review in this study included, PubMed, MEDLINE, Academic Search Primer, ERIC, CINAHL Plus, and EBSCO. The articles retrieved by database searches were classified and screened for relevance by using EndNote. Of the 936 articles retrieved, 18 discussed “voice assessment and thyroidectomy”, 3 discussed “voice therapy and thyroidectomy”, and 11 discussed “surgical interventions for voice restoration after thyroidectomy”. Only 3 studies discussed topics related to “swallowing function assessment/treatment and thyroidectomy”. Although many studies have investigated voice changes and assessment methods in thyroidectomy patients, few recent studies have investigated speech therapy after thyroidectomy. Additionally, some studies have addressed dysphagia after thyroidectomy, but few have discussed assessment and treatment of dysphagia after thyroidectomy.

Keywords: Speech therapy; voice therapy; dysphagia therapy; swallowing therapy; thyroidectomy; recurrent laryngeal nerve paralysis; dysphonia; dysphagia; vocal paralysis; intervention; rehabilitation

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Introduction

Patients who have undergone thyroidectomy often complain of changes in voice function (dysphonia) and swallow function (dysphagia) (1). Although causes of dysphonia and dysphagia may vary, one of the most common causes is recurrent laryngeal nerve paralysis which can lead to vocal fold paralysis (2,3). Additionally, vocal fold paralysis often causes insufficient glottic closure which can then cause dysphonic symptoms such as, weakness,

breathiness, and reduced voice range and loudness (4). Vocal fold paralysis can also cause dysphagic symptoms such as coughing, choking, and aspiration pneumonia. Because patients who have received thyroidectomy often have difficulty swallowing, another possible outcome is malnutrition (5). The various surgical interventions, for dysphonia and dysphagia are well documented and widely reported (1,2,6,7). However, non-surgical options such as speech therapy are also available for improving voice and swallowing functions. Speech therapy is a rehabilitative

therapy performed by speech-language pathologists to improve communication and swallowing functions. From a therapeutic perspective, the objectives of treatment for vocal fold paralysis are restoring voice function and achieving sufficient glottic closure (8). Thus, successful therapy for vocal fold paralysis can substantially improve daily function and quality of life.

Various techniques have been developed for treating dysphonia and dysphagia caused by vocal cord paralysis (9). Some of the techniques for voice therapy and dysphagia therapy will be discussed later in this paper. Techniques for assessing voice function and swallowing function before and after speech therapy have also been developed. Regardless of the cause of vocal paralysis, the effectiveness of speech therapy for improving dysphonia and dysphagia is well documented (10,11).

Pre-therapy assessment

Some researchers suggest that patients referred for thyroidectomy should be assessed for voice and swallow function immediately before surgery (12). Most patients are assessed for baseline voice function and/or swallowing function after undergoing thyroidectomy. Pre-therapy assessment is essential for establishing the treatment goals and appropriate procedures for each patient as patients who have the same diagnosis may have different symptoms and different responses to therapy.

Voice assessment

Voice assessment can be classified into three categories: subjective assessments by the patient, subjective assessments by the clinician, and objective methods.

Subjective assessments of voice function performed by the patient include self-assessment instruments such as the Voice Handicap Index (VHI) (13) and the Voice-Related Quality of Life Measure (V-RQOL) (14). Both the VHI and the V-RQOL are used for self-assessment of the impact of voice on quality of life. Various translations of the VHI have been validated in the literature. Additionally, two versions of the VHI have been validated in previous studies: a 30-item instrument, the VHI-30 (13), and a 10-item instrument, VHI-10 (15). VHI-30 is divided into three 10-item sections for assessing physical (P) functional (F) and emotional (E) aspects of the effects of voice function on quality of life. The patients completed the VHI according to their vocal function at the time of assessment

and according to the frequency at which they encountered each handicapping condition in daily life.

The 10-item V-RQOL surveys two domains, a social-emotional domain (4 items) and a physical function domain (6 items). The V-RQOL requires patients to assess their voice function in the past 2 weeks.

The second category of voice assessment methods, instruments designed for subjective assessment by clinicians, includes subjective perceptual grading scales such as the GRBAS scale (16) and the Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V) (17,18).

The GRBAS scale requires the clinician to assess five parameters of voice quality (grade, roughness, breathiness, asthenia, and strain) on a scale from 0 to 3 (normal, mild severity, moderate severity, and high severity, respectively). In contrast, the CAPE-V requires the patient to perform three specific vocal tasks. The speech-language pathologist evaluates six vocal qualities: overall severity, roughness, breathiness, strain, pitch, and loudness. A 100-mm visual analog scale (VAS) is then used to record and evaluate each voice quality features.

The third category of voice assessment methods is objective evaluation of acoustic voice analysis (3) and aerodynamic measurements of phonation (19).

Acoustic voice analysis has been simplified by the recent availability of speech analysis software programs for obtaining objective acoustic data for the voice. Based on voice samples such as sustained vowels or other speech sounds recorded by the patient, these software programs provide data such as fundamental frequency (F0), jitter, shimmer, noise-to-harmonic ratio (NHR), and voice turbulence index (VTI). For some patients, a voice range profile program may also be used to determine the ranges of pitch (frequency) and/or loudness (amplitude).

Objective assessment can also be performed by aerodynamic measurements of phonation, which typically include mean airflow rate, phonation threshold pressure, and air pressure. One limitation of aerodynamic measurements, however, is the specialized equipment needed for data collection. Additional voice data that are considered objective but not aerodynamic include maximum phonation time (MPT) and S/Z ratio (20).

Swallowing assessment

Swallowing function is mainly assessed by image studies and by physiologic evaluation. In some cases, swallowing function can also be assessed by quality of life

questionnaires such as the 44-item Swallowing Quality-of-Life Questionnaire (SWAL-QOL) (21), which surveys ten aspects of quality of life, and the Eating Assessment Tool (EAT-10) (22), a 10-item self-administered questionnaire used to assess symptom-specific outcomes.

The most informative image study for swallowing function is the Videofluoroscopic Swallowing Study (VFSS), also known as the Modified Barium Swallow (MBS) study (9,23,24). In some cases, the fiberoptic endoscopic evaluation of swallowing (FEES) is also performed (25,26). The VFSS is usually administered jointly by a radiologist and a speech-language pathologist. The VFSS examination requires the patient to swallow a liquid bolus of varying consistency and/or a solid bolus of varying texture mixed/coated with barium. The swallowing process is recorded by videofluoroscopy (X-ray video). The posture and/or head position is adjusted as needed to obtain the optimal image. The VFSS enables clear observation and documentation of all stages of the swallowing process, including the oral, pharyngeal, and esophageal stages. The VFSS also enables evaluation of airway integrity before, during, and after the swallow (25).

The FEES is relatively safe and easier to administer compared to VFSS (27). For example, FEES does not require exposure to radiation and is generally well tolerated by patients. The FEES can also be performed at the bedside (28). Another advantage of FEES is that the anatomy and physiology of the swallow process (26) can be recorded by fiberoptic rhinopharyngoscopy.

Physiologic methods of evaluating the swallow process (9) assess various oral and pharyngeal mechanisms such as lip closure, lingual elevation, tongue to palatal seal, bolus preparation/mastication, bolus transport/lingual motion, initiation of pharyngeal swallow, soft palate elevation and retraction, laryngeal elevation, anterior hyoid excursion, laryngeal closure, pharyngeal contraction, pharyngoesophageal segment opening, tongue base retraction, and epiglottic inversion (29). Dysphagia screening tests performed during swallow assessment may also include water swallow test (30), repetitive saliva swallow test (31) etc., or trial oral intake of liquids of varying consistency and/or solids of varying texture (9).

Voice therapy

Patients with recurrent laryngeal nerve paralysis often experienced breathiness and weak voice. For these patients, the main goal of therapy is restoring sufficient voice function. Voice therapy usually requires multiple sessions



Figure 1 A speech-language pathologist performing head positioning on a patient.

and must be performed by a speech-language pathologist with expertise in voice disorders.

The many different voice therapies developed so far can be classified as direct or indirect interventions. According to a recent research, direct interventions include interventions for improving auditory, vocal, somatosensory, musculoskeletal, or respiratory function (32). Indirect interventions include, but are not limited to, vocal hygiene education and counseling.

Voice therapy orientations can also be classified as hygienic, symptomatic, and physiologic (33). Hygienic approach to voice therapy educates patients in vocal hygiene and in the need to develop good habits such as maintaining hydration and voice rest. Symptomatic approach to voice therapy resolves dysphonic symptoms such as pitch, loudness, and voice quality. Examples of symptomatic voice therapy include “chant talk”, “ear training” “head positioning”, and “pushing approach” (34). *Figure 1* shows a speech-language pathologist performing head positioning on a patient. Finally physiologic approach to voice therapy, which was not proposed until the 1990s (35), and is considered the most holistic of the three approaches (36), emphasizes the need for maintaining a good balance of all systems with roles in voicing (phonation). Examples of physiologic voice therapy include “Vocal Function Exercise” (37), and “Resonant Voice Therapy” (38).

Voice therapy for patients with insufficient voicing typically include “head positioning”, “pushing approach”, “vocal function exercise” and “resonant voice therapy” (4).

Dysphagia therapy

In most parts of the world, dysphagia therapy is performed

Table 1 Rationale for swallowing compensatory strategies for pharyngeal dysphagia

Compensatory strategy	Rationale
Chin tuck	Reduce laryngeal penetration
	Reduce premature spillage
	Reduce pharyngeal residue
Head rotation	Enhance unilateral pharyngeal closure
	Enhance opening of the upper esophageal sphincter
	Enhance unilateral pharyngeal closure
Head tilt	Utilize gravity to divert bolus
	Improve tongue base motion
Effortful swallow	Reduce pharyngeal residue
	Enhance airway protection
Supraglottic swallow	Enhance glottis closure
	Prevent premature spillage
Oral hold	Prevent premature spillage
Diet/bolus modification	Increase swallow safety and efficiency

by speech-language pathologists (39). The chief complaints of patients with dysphagia are choking and difficulty swallowing. Although various interventions and behavior modifications (e.g., exercise, maneuvers, etc.) have been proposed for treating dysphagia (40,41), the most appropriate intervention depends on the specific dysphagia status of the patient.

Swallowing interventions can be classified as sensory methods (bolus modification, stimulation, biofeedback), compensatory methods (chin tuck, head rotation, head tilt, breath holding, bolus modification), motor-with-swallow methods (Mendelsohn maneuver, effortful swallow, supraglottic swallow, Masako exercise), and motor-without-swallow methods (range of motion exercise, muscle strengthening exercise, Shaker exercise, vocal exercise, breath holding) (42).

Examples of safe swallow compensatory techniques (9,23,39,43) include posture adjustments, maneuvers, bolus modifications, and sensory enhancements. Patients with vocal paralysis often experience pharyngeal dysphagia (11). Techniques for improving pharyngeal swallow include, “chin tuck”, “head rotation”, “head tilt”, “effortful swallow”, “supraglottic swallow”, “oral hold” and “diet modifications”.

Table 1 shows the rationale for each technique (5).

Post-therapy assessment

The same method used to assess voice and/or swallow function before therapy should be used after therapy. The aims for post-therapy assessment are to evaluate the effectiveness of the therapy and the need for further treatment or carry-over tasks.

Special considerations for speech therapy after thyroidectomy

Apart from possible laryngeal nerve paralysis after thyroidectomy, other factors must be considered when administering speech (voice and swallowing) therapy. The literature on speech-language pathology shows little or no research on the timing of voice and/or swallowing therapy after thyroidectomy. Head and neck stretching and relaxation techniques are often used in speech therapy for treating dysphonia and dysphagia (9). Before beginning speech therapy, adequate wound healing must be confirmed so as to avoid separation of the incision wound and bleeding (44). Some patients who have received thyroid surgery complain of dizziness, which may result from metabolic disturbance (44). Speech therapy should not begin until the physician addresses all complications and/or concerns.

Another important consideration is the role of strap muscle division. Laryngeal intrinsic muscles have well known roles in phonation and voicing, and laryngeal extrinsic muscles, e.g., the strap muscles, have important roles in pitch and loudness. Strap muscle division may cause dysphonia and sometimes dysphagia (45). Voice-related symptoms of strap muscle (e.g., sternohyoid) division often include hoarseness, vocal fatigue, impaired voice projection, and loss of upper range of voice pitch (45). Contraction of the sternohyoid and sternothyroid muscles (strap muscles) increases pressure on the subglottis, and contracts the cricothyroid muscles. The resulting increase in vocal fold length then increases fundamental frequency (pitch) and vocal intensity (loudness) (46). Treatment for dysphonia and dysphagia related to strap muscle division include muscle relaxation techniques and muscle strengthening exercises.

Additional concerns are the same as those observed in patients who undergo endotracheal intubation under general anesthesia (45,47). Endotracheal intubation is an invasive procedure associated with a high risk of complications. For

Table 2 Summary of search data

Search terms	Database						Total	Duplicates discarded
	PubMed	MEDLINE	Academic search primer	ERIC	CINAHL Plus	EBSCO		
Voice therapy thyroidectomy	223	46	14	1	3	59	346	229
Voice therapy thyroid	461	126	56	4	1	182	830	508
Speech therapy thyroid	65	61	34	4	4	97	265	95
Speech therapy thyroidectomy	12	11	5	1	2	19	50	18
Dysphonia thyroid	162	158	95	1	8	246	670	227
Dysphonia thyroidectomy	65	65	37	1	4	101	273	93
Voice speech therapy thyroid* paralysis	12	12	3	4	1	19	51	16
Nerve palsy thyroidectomy dysphonia	13	5	6	1	34	14	73	53
Dysphagia therapy thyroidectomy	147	39	14	0	3	115	318	155
Dysphagia therapy thyroid*	329	109	50	3	8	150	649	368
Swallow therapy thyroid*	50	22	7	3	2	27	111	58
Dysphagia laryngeal nerve thyroid*	47	29	19	0	3	47	145	61

*, wildcard/truncation of a search term beginning with thyroid.

example, the intubation tube may directly irritate the mucosa of the larynx and the trachea. Mechanical injury to the mucosa is also possible (48,49). Other common complications include hemorrhage, infection, and fistula, etc. (44).

Review of current research

Recent studies related to speech therapy for recurrent laryngeal nerve paralysis after thyroidectomy was retrieved from six databases: PubMed, MEDLINE, Academic Search Primer, ERIC, CINAHL Plus, and EBSCO. *Table 2* shows that searches were limited to human studies published in 2001–2017. The search terms were “voice therapy thyroidectomy”, “voice therapy thyroid”, “speech therapy thyroid”, “speech therapy thyroidectomy”, “dysphonia thyroid”, “dysphonia thyroidectomy”, “voice speech therapy thyroid* paralysis”, “nerve palsy thyroidectomy dysphonia”, “dysphagia therapy thyroidectomy”, dysphagia therapy thyroid*”, “swallow therapy thyroid*”, and “dysphagia laryngeal nerve thyroid*”. After using Endnote X8.0.1 (50) to categorize the studies and eliminate duplicates, the first author manually screened the remaining abstracts. The review included full-text articles written in English and related to speech therapy for recurrent laryngeal nerve paralysis after thyroid surgery.

After discarding duplicate studies and studies published

in languages other than English, 936 articles remained. Finally, the abstracts of the 936 articles were screened for relevance. Eighteen studies discussed voice assessment and thyroid surgery with or without recurrent laryngeal nerve paralysis; three studies discussed voice therapy and thyroid surgery with or without recurrent laryngeal nerve paralysis, and 11 studies discussed surgical interventions for voice restoration. Only three studies discussed swallowing assessment/treatment and thyroid surgery with or without recurrent laryngeal nerve paralysis.

Of the 18 studies on voice assessment, VHI was used in nine (6,51–58), computerized voice analysis program was used in eight (53,54,58–63), GRBAS was used in seven (6,52,53,58,62,64,65), MPT was used in six (52,53,59,60,62,65), CAPE-V was used in four (6,55,63,66), and other non-specific idiosyncratic tools were used in four (6,61,64,67). Aerodynamic measurement (20), Dysphonia Severity Index (55), Voice Range (62), and the Evaluation of Ability to Sing Easily (51) were mentioned one time each. *Table 3* shows the assessment tools and their frequency of use in the 18 papers. Notably, most studies used more than one voice assessment tool.

Of the three papers on voice therapy and thyroid surgery (1,6,68), two were literature reviews (1,6). Both reviews mentioned the option of voice therapy for improving voice outcome after thyroid surgery. One review discussed

Table 3 Frequency of vocal assessment tools utilized in studies

Tools	Frequency
VHI (including Singing VHI)	9
Computerized Voice Analysis program	8
GRBAS	7
Maximum phonation time (MPT)	6
CAPE-V	4
Other idiosyncratic tools	4
Aerodynamic measurement	1
Dysphonia Severity Index (DSI)	1
Voice Range	1
Evaluation of Ability to Sing Easily (EASE)	1

VHI, Voice Handicap Index.

Table 4 Frequency of surgical management utilized in studies

Type of surgery	Frequency
Reinnervation	6
Injection laryngoplasty/medialization	5
CO ₂ laser arytenoidectomy (60)	1

counseling and education interventions (6), and the other discussed voice outcome after voice therapy and injection laryngoplasty (68).

Reinnervation/nerve reconstruction (6,53,69-72) and injection laryngoplasty/vocal fold medialization (1,6,68,73,74) were the two most frequently mentioned procedures in studies that discussed surgical options for voice restoration. *Table 4* shows the frequency of surgical procedures used in the 11 studies.

Three studies discussed swallow status after thyroid surgery (64,75,76). Two studies (75,76) that had been performed at the same institution had the same first authors and the same second authors. All three of the studies on swallow status after thyroid surgery discussed both voice and swallow outcomes. Swallow function was assessed by a questionnaire in two of the studies and by VFSS in one of the studies (64). Dysphagia therapy was not mentioned.

Database searches for studies published during 2001–2017 showed that changes in voice and in swallow status were common in patients who had received thyroidectomy, especially for patients who had recurrent laryngeal nerve

paralysis after thyroidectomy. Although many studies have discussed changes in voice and swallow functions, few have discussed the use of speech therapy for improving these functions. Additionally, studies that have discussed speech therapy for treating voice disorder (dysphonia) only briefly discuss protocols, techniques and rationales for speech therapy in these patients. Even fewer studies have discussed the use of speech therapy or other rehabilitative interventions for treating thyroidectomy patients who have dysphagia.

Conclusions

Changes in voice and swallowing functions are common complications of thyroidectomy. Although the effectiveness of speech therapy for treating dysphonia and dysphagia has been well established in the literature in recent decades, few studies have investigated the use of speech therapy for treating these disorders after thyroidectomy. A possible explanation is that surgeons, general practitioners, nurses, speech-language pathologists, and other professionals (e.g., psychologists, physical therapists, occupational therapists, pharmacists, etc.) who treat thyroidectomy patients may not be fully aware of how thyroidectomy can impair these functions. According to the personal experience of this first author, issues related to thyroid diseases and thyroid surgery are rarely discussed in either undergraduate or graduate level courses in speech-language pathology. Therefore, the need for continuing education in thyroid disease and treatment, and increased awareness of a multidisciplinary approach to treatment is essential for all associated healthcare professionals and would be highly beneficial to these patients (6,77).

In patients who undergo thyroidectomy with recurrent laryngeal nerve paralysis, loss of voice and/or swallowing function are very common. Many recent studies have discussed surgical interventions for improving voice and swallowing functions in patients who suffer from recurrent laryngeal nerve paralysis after thyroidectomy. Many studies have also discussed the effectiveness of speech therapy for treating dysphonia and dysphagia after vocal fold paralysis. However, few studies have specifically investigated the use of speech therapy for treating dysphonia and dysphagia in patients who suffer from recurrent laryngeal nerve paralysis after undergoing thyroidectomy. The use of speech therapy for treating recurrent laryngeal nerve paralysis after thyroidectomy merits further study.

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Footnote

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