

## Effect of Teaching Protocol of Neck Exercises and Wound Massage on Wound Adhesion and Voice Changes among Post-thyroidectomy Patients

Manal Sayed Atya<sup>1</sup>, Nagm Eldin Abu Elnga Ahmed<sup>2</sup>, Eman Mohammed Hashim<sup>3</sup> & Fatma Gareh Ahmed<sup>4</sup>

<sup>1</sup>Lecturer of Medical, Surgical Nursing, Faculty of Nursing, Assiut University, Egypt.

<sup>2</sup>Lecturer of General Surgery, Faculty of Medicine, Assiut University, Egypt.

<sup>3</sup>Lecturer of Medical, Surgical Nursing, Faculty of Nursing, Assiut University, Egypt.

<sup>4</sup>Lecturer of Medical, Surgical Nursing, Faculty of Nursing, Assiut University, Egypt.

### Abstract:

**Background:** Changes of voice and neck discomfort are two undesirable outcomes after thyroidectomy operations that are related to local wound adhesion. **Aim:** To evaluate whether teaching protocol of neck exercises and wound massage can reduce wound adhesion and voice changes among post-thyroidectomy patients. **Research design:** A quasi-experimental research design (study/ control) was utilized to conduct this study. **Sample:** A purposeful sample of 60 adult patients. Patients were divided into two groups as study (n = 30) and control (n = 30). **Setting:** The study was conducted in the General Surgical Departments (A, B, and C) and General Surgical Outpatient Clinic at Main Assiut University Hospital. **Tools:** Four tools were utilized; **Tool (I):** A structured interview questionnaire, **Tool (II):** The patient and observer scar assessment scale (POSAS), **Tool (III):** Voice Handicap Index (VHI-10) questionnaire & **Tool (IV):** Compliance assessment sheet. **Results:** There were highly statistically significant differences between study and control groups regarding wound adhesion and voice changes after applying the teaching protocol of neck exercises and wound massage (2 and 4weeks postoperatively) (P-value<0.001\*\*). **Conclusion:** Applying a teaching protocol of neck exercises and wound massage post- thyroidectomy significantly reduced wound adhesion and improved voice changes in the study group compared to the control group. **Recommendations:** Neck exercises and wound massage are recommended to be an integral part of the pre-operative nursing teaching for patients undergoing thyroidectomy and a booklet should be available at the surgical wards as a reference.

**Keywords:** Neck exercises, Post-thyroidectomy, Voice changes, Wound massage & Wound adhesion.

### Introduction:

Thyroid disorders are among the most common health problems in the world. Thyroid dysfunction is one of the most prevalent endocrine disorders and is becoming more prevalent globally as it affects between 30% and 40% of patients who visit endocrine clinics. An earlier epidemiological study in Egypt found that 19.2% of patients with hyperthyroidism and 15.8% of patients with subclinical hyperthyroidism had thyroid dysfunction, which affected about 30% of patients at the endocrine clinic (Rashad & Samir, 2019).

A thyroidectomy is a common procedure used to treat a variety of benign and malignant thyroid conditions. In the United States, between 118,000 and 166,000 people undergo thyroidectomies annually, a threefold increase in thyroid operations over the past three decades (D'Orazi et al., 2019).

Thyroidectomy is a surgical procedure to remove all or part of the thyroid gland. It is a routine procedure in contemporary medicine and recognized to have a low incidence of both morbidity and mortality. It is indicated to treat malignancy, benign disease, or hormonal disease that is not responsive to medical

management. Thyroidectomy commonly falls into one of three categories; total thyroidectomy, which aims to achieve complete macroscopic removal of the thyroid tissue; subtotal thyroidectomy, in which bilateral thyroid remnants are left; and thyroid lobectomy, which entails removal of half of the thyroid gland that has the nodule (Haugen et al., 2016).

Even in the absence of laryngeal nerve injuries, a significant number of patients reported post-thyroidectomy voice and swallowing symptoms (PVSS), such as globus sensation, dysphagia, sticky mucus, or throat clearing. After thyroid surgery, 30% to 80% of patients report voice changes. The symptoms can be vague, such as diminished vocal power or trouble maintaining lengthy utterances, or extremely hoarse. Even in the absence of the laryngeal nerve injury, PVSS can develop (Rodriguez et al., 2023). Following surgery, scar adhesion may be the cause of the symptoms (Lee et al., 2018).

Following thyroid surgery, there may be scar adhesions, which include adhesions between the subcutaneous fascia and the tissues surrounding the airways. Inhibited swallowing, a feeling of a foreign

body in the throat, dysphagia, a pulling sensation around the neck, and vocalization issues are just a few of the symptoms that these cervical adhesions may cause (Yu et al., 2021).

Early neck exercises can help patients undergoing thyroid surgery improve their range of motion and reduce postoperative neck discomfort, wound adhesion, or scar hypertrophy. Neck exercises consist of simple neck movements that improve patients' neuromuscular flexibility and coordination while minimizing pain and muscle weakness (Turkmen et al., 2020).

Wound massage is a therapeutic manipulation of the fibrous tissue that forms during the healing process of a wound (Scott et al., 2022). Massage can release shortened bands and adhesions in the muscles and underlying subcutaneous structures, which will increase range of motion and help the patient feel pain-free. By restoring the overall movement of the larynx, scar tissue release aids patients in recovering from neck discomfort and voice changes following thyroid surgery (Hasan & Al Dabbagh, 2021).

The usefulness of neck exercises, which should be carried out even if the patient suffers less discomfort or has unrestricted movement of their head, neck, and shoulders, is an important point that nurses ought to emphasize to post-thyroidectomy patients. Additionally, nurses must give postoperative instructions on medication administration, wound care, diet, daily activities and follow-up. Along with verbal and written instructions on the procedure, those instructions should also include neck exercises (Thorsen et al., 2022).

### Significance of the study:

Records from Assiut University Hospitals show that there were "250" thyroidectomy operations performed between 2020 and 2021. The frequency of thyroid disorders, including thyroid cancer, has rapidly increased in recent years, which has led to an increase in the frequency of thyroidectomy operations. Even in the absence of recurrent laryngeal nerve (RLN) injury, voice alteration is common after thyroid surgery because scar adhesion after surgery can cause it to happen. Changes in voice have a substantial impact on persons recovering from thyroid surgery since speech is a tool for thinking aloud, sharing ideas, and participating in social activity. In order to aid post-thyroidectomy patients in reducing wound adhesion and enhancing voice changes, this study emphasises the effectiveness of applying a teaching protocol of neck exercises and wound massage.

### Aims of the study:

#### General aim:

The current study was aimed to evaluate the effect of teaching protocol of neck exercises and wound

massage on wound adhesion and voice changes among post-thyroidectomy patients.

#### Specific aims;

1. Assess wound adhesion and voice changes among post-thyroidectomy patients.
2. Designing and applying teaching protocols for neck exercises and wound massage.
3. Assess the compliance of post- thyroidectomy patients with the teaching protocol of neck exercises and wound massage.
4. Evaluate the effect of applying the teaching protocol of neck exercises and wound massage on wound adhesion and voice changes among post-thyroidectomy patients.

**Research hypotheses:** The following research hypotheses were incorporated:

1. Wound adhesion among post-thyroidectomy patients would be reduced by teaching the protocol of neck exercises and wound massage.
2. Voice changes among post-thyroidectomy patients would be improved by teaching the protocol of neck exercises and wound massage.
3. Positive correlation between patient adherence to the neck exercises & wound massage protocol and wound adhesion & voice changes.

**Null Hypothesis:** The neck exercises and wound massage protocol won't have effect on post-thyroidectomy patients' voice changes or wound adhesion, according to the null hypothesis.

#### Patients and Methods:

##### Research design:

This study conducted a quasi-experimental (Study/control) research design. Which is a type of evaluation aims to determine if a program or intervention has an intended effect on a study's participants. In such a type of research design, an intervention is observed, and a control group who did not take part in the initiative under study is frequently used. In order to compare data from people who did participate in the initiative, this group is used (Miller et al., 2020).

##### Setting:

The study was conducted in the General Surgical Departments and Outpatient's Clinic at Main Assiut University Hospitals. General Surgical departments are located on the second floor and are divided into three sectors (Surgical Units A, B, and C). The outpatient clinic is located on the first floor and is dedicated to the follow-up of patients after surgeries. Owing to the large number of patients attending these departments, which were specialized on the admission of those patients, the study settings were chosen.

##### Sample:

The study recruited a purposive sample of 60 adult post-thyroidectomy patients. The sample divided

randomly and alternatively into two equal groups, study (n = 30) and control (n = 30). The study group received a teaching protocol of neck exercises and wound massage, while the control group received routine hospital care.

#### **Inclusion criteria**

Patients who were between the ages of 18 and 65, had various thyroid pathologies, were undergoing thyroidectomy surgeries, gave their informed consent after being informed of the study's objectives, could understand the information provided, and had no difficulty preventing verbal communication.

#### **Exclusion criteria**

The study excluded patients who had abscess or hematoma formation, wound infection, recurrent thyroid pathology prior to surgery, a history of prior neck surgery, cervical problems prior to surgery, and evidence of recurrent laryngeal nerve injury.

**Sample size:** G-Power software was used to determine the sample size, which were 60 cases. Two-tailed sample size calculations are used to test differences between two independents. "Power 95%," "effect size 0.8 "and" error 0.05" were used.

#### **Tools:**

Four tools for data collection were used to achieve the aims of the study

#### **Tool (I): A Structured interview questionnaire:**

It was developed by the researchers to assess demographic and medical data of patients: It included two parts

**Part (1):** Demographic data: It included (6) items related to patients age, gender, occupation, marital status, residence and level of education.

**Part (2):** Medical data included (4) items (length of hospital stay, presence of chronic diseases, cause of thyroidectomy and type of thyroidectomy).

#### **Tool (II): The patient and observer scar assessment scale (POSAS):**

The Arabic version of POSAS developed by **Nossier et al., (2018)** and adapted by researchers to assess wound adhesion. It consisted of two numeric scales (the observer scale and the patient scale). The observer component was composed of six parameters of scars: vascularity, pigmentation, thickness, relief, pliability, and surface area. The patient scale consisted of 7 items; 6 of them were for evaluating the scar (pain, itching, colour, elasticity, thickness, and irregularity assessment), and 1 is for evaluating the general opinion about the scar. The scale score calculated over the first six items.

#### **Scoring system:**

Each item of the patient and observer scale has a Likert-type score ranging from 1 to 10.

Normal skin is represented by 1, while the greatest scarring is represented by 10.

This scale has a total score of 60. The lowest score on the scale (6) representing normal skin, while the maximum score (60) representing the worst scar imaginable.

It was used three times: one week postoperatively (before applying of teaching protocol of neck exercises and wound massage), two weeks postoperatively (after applying of teaching protocol of neck exercises and wound massage), and four weeks postoperatively (after applying of teaching protocol of neck exercises and wound massage).

#### **Tool (III): Voice Handicap Index (VHI-10) questionnaire:**

The Arabic Version of the Voice Handicap Index (VHI-10) developed by **Farahat, (2012)** and adapted by researchers to evaluate patients' perceptions of voice quality and subjective voice function. VHI-10 is a set of ten statements about voice function that rated on a five-point Likert scale.

**Scoring system:** The VHI included 10 items, each scored on a 5-point scale ranging from "never" (0 point), "almost never or occasionally" (1 point), "sometimes" (2 point), "almost always" (3 point), and "always" (4 point). The VHI score is therefore graded on a total of 40 points. The total score ranged from 0 (no impairment) to 40 (maximum impairment).

The items are divided into three subdomains.

- **The functional (F)** subscale from items 1–5 reflected statements that describe the impact of a person's voice disorder on his or her daily activities.
- **The physical (P)** subscale from items 6–8 reflected statements representing self-perceptions of laryngeal discomfort and voice output characteristics.
- **The emotional (E)** subscale from items 9–10 consisted of statements representing a person's affective (e.g., feeling) responses to a voice disorder.

It was used three times: one week postoperatively (before applying of teaching protocol of neck exercises and wound massage), two weeks and four weeks postoperatively (after applying of teaching protocol of neck exercises and wound massage).

**Tool (IV): Compliance assessment sheet:** It was developed by the researchers based on a literature reviews (**Lee et al., 2018 & Hasan and Al Dabbagh, 2021**) to assess study group patients' compliance with neck exercises and wound massage after the 2<sup>nd</sup> and 4<sup>th</sup> weeks.

#### **Scoring system:**

- It was calculated by comparing the accomplishments of patients with exercises and massage against the target accomplishment which are (Wound massaging technique should be performed for at least 10 minutes, three times a day) after one week from the thyroidectomy operation to

make sure that the wound is healed and there are no signs of infection and neck exercises included eight neck stretching exercises practiced three times per day (morning, afternoon, and evening).

- Higher percentages reflect higher compliance.

#### Tools validity and reliability:

The study contents was reviewed and approved by five experts (three medical-surgical nursing staff and two general surgery staff at Assiut University) to ensure validity of the content. The Cronbach's alpha coefficient of (tool II) was 0.914 for the PSAS and 0.724 for the OSAS, and the test-retest reliability coefficient was 0.756 for the PSAS and 0.580 for the OSAS. **(Tool III) VHI-10** showed high internal consistency (Cronbach's  $\alpha = 0.88$ ). Excellent test-retest reliability was found for the total scores of the Arabic VHI-10 ( $r = 0.920$ ,  $P = <0.001$ ) and the compliance assessment sheet showed high internal consistency (Cronbach's  $\alpha = 0.82$ ). Excellent test-retest reliability was found as ( $r = 0.890$ ,  $P = <0.001$ ).

#### Procedure:

##### Administrative approval:

Official approval and administration permission were obtained from the General Surgical Department and Outpatient Clinics at Main Assiut University hospitals to gather the needed data after the study aim explanation.

##### Ethical Consideration:

All research ethics principles were fulfilled. A research proposal was approved by the ethical committee in the faculty of nursing. After explaining the nature and goal of the study to the dean of the faculty of nursing, the director of the general surgical departments, and the director of the outpatient clinics, official approval and consent were obtained before the pilot study and the actual study were conducted. The studied patients were entitled to refuse to participate and/or withdraw from the study at any time without any reason. Participants received assurances that all of their information would be maintained in the utmost confidentiality. Before beginning data collection, the patients were informed of the study's objectives. Oral consent was taken from patients who agreed to participate after being reassured about the confidentiality of the information and how it would be used for purposeful research. During the application of the study, there was no risk to the study subject.

##### Pilot study:

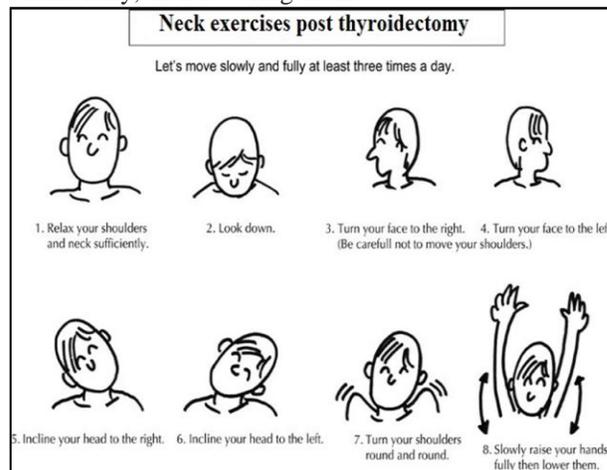
It was carried out on 10% of patients (6 patients) post-thyroidectomy. The pilot study was done before starting data collection to test the feasibility of the tools and make the necessary modifications. Also, it estimates the time needed to fill out the study tools. There was no difficulty with the tools. Those patients were included in the study.

#### Fieldwork description:

##### Teaching protocol of neck exercises and wound massage for post thyroidectomy patients:

The researchers developed a teaching protocol for neck exercises and wound massage after reviewing the related literature and available resources. It was prepared in simple Arabic and illustrated with coloured photos to help the participants understand the content.

- **Neck exercises:** The number of exercises was eight as shown in figure (1), including: 1- a relaxation exercise for the shoulders and neck; 2- a neck flexion exercise by looking down; 3- turning the face to both sides, the right and the left; 4- inclining the head to both sides; 5- shoulder shrugging exercise 6-nodding exercise on both sides 7: turning shoulders round in both directions; and 8: lifting arms fully, then lowering them.



**Figure (1) shows: Neck Exercises post Thyroid Surgery. Adapted from: Jang et al., (2014).**

##### Wound Massage:

After a week from the thyroidectomy operation to ensure that the wound healed and free of infection, study group patients encouraged to conduct wound massaging techniques (for at least 10 minutes, three times a day). The purpose of the massage technique was to release the tension bands that held the strap muscles and the larynx together, enabling the larynx to move vertically and alleviating the patient's uncomfortable neck pulling sensation (**Hasan and Al Dabbagh, 2021**).

##### Data collection stage:

- Sampling and data collection lasted six months, from June 2022 to November 2022. Patients were divided into two groups: the study group (30 patients) and the control group (30 patients).
- The data were collected by the researchers twice a week. The data were collected on morning shifts by interviewing patients individually.

**Operational Design:**

Technique for data collection: this study was carried out in three phases:

**Assessment and planning phase:**

- This is the first phase of the intervention, where in the first meeting with the patients, the researchers introduced themselves to the participants and clarified the nature and purpose of the study. Participants' approval was obtained. Each participant was interviewed individually by the researchers to collect demographic and medical data (**pre-test**) using **Tool I** (Parts 1 and 2) from patients and their current medical records as baseline data. This was done preoperatively.
- The structured interview was filled out by the researcher, and the length of meeting was 15- 20 minutes. The researchers interviewed the patients in the General Surgical Departments at Main Assiut University hospitals and explained to them the importance of neck exercises and wound massage on wound adhesion and voice changes.

**Implementation phase:**

- This phase began one week postoperatively, when patient came for dressing change.
- Initially, wound adhesion was assessed using the Arabic version of the patient and observer scar assessment scale (**Tool II**), and the voice function was assessed using the voice handicap index (**Tool III**). This was assessed one week postoperatively when the patient came for dressing change and before applying the teaching protocol of neck exercises and wound massage.
- **The teaching protocol of neck exercises and wound massage:**
- The teaching protocol was developed by the researchers based on the review of relevant literatures and available resources.
- At the beginning, for the study group researchers made revisions to the aims of neck exercises and wound massage in relation to wound adhesion and voice changes. Reinforcement of teaching was performed according to patient's needs to ensure their understanding.
- Then, the researchers made a demonstration about neck exercises to be performed. Eight stretching and movement exercises were performed, with a focus on the anterior and posterior neck musculature as well as the muscles around the shoulders. It was avoided to stretch against the incision's perpendicular. Patients were instructed to perform each exercise three times per day (morning, afternoon, and evening).
- Lastly; The researchers explained the instructions about the massage technique for the wound to study group as the following:

- » Apply gentle pressure with fingers to the surgical site (healed incision), gliding them over the underlying tissues.
- » Make broad circles with the fingers over the underlying tissues rather than rubbing the skin's surface.
- » Glide fingers vertically down the incision site, extending them towards chin.
- » Continue to massage for around 10 minutes each, at least three times per day.
- » Stop the massage right away and call the physician if complained of pain, redness, or discharge while it was being given.
- Each patient repeated all instructions twice, and the researchers made sure they could use the teaching protocol as a reference if necessary at home.
- To increase adherence to the exercises at home, the participants were given a copy of the teaching protocol about the exercises and wound massage, and an additional copy was handed to the General Surgical Departments staff nurses and Outpatient Clinic nurses at Main Assiut University hospitals as a reference for all patients admitted to these departments.
- While the control group received the routine nursing care of the hospital.
- Patients were asked to come after the 2<sup>nd</sup> and 4<sup>th</sup> weeks from the beginning of applying neck exercises and wound massage for follow-up, in which the researchers assessed the wound adhesion and voice changes.
- A telephone follow-up consultation was conducted for patients by the researchers, to inquire about their overall well-being and to assess their compliance with neck exercises and wound massage.

**Evaluation phase:**

It was conducted at General Surgical Outpatient Clinics at Main Assiut University Hospitals. This phase was performed twice: the first evaluation was at the end of the second week (posttest), and the second evaluation follow-up was after the 4<sup>th</sup> week from the implementation of neck exercises and wound massage. Patients were evaluated by using **Tool II** to assess the wound adhesion, **Tool III** to assess the voice changes, and **Tool IV** to assess patients' compliance with the instructions given in the booklet.

**Statistical analysis:**

The obtained data were reviewed, prepared for computer entry, coded, analyzed, and tabulated. Descriptive statistics (frequencies, percentage, mean, and standard deviation) were done using computer intervention (SPSS version 22, Excel 2016); analysis of variance was done by using the chi-square test (P-

value < 0.05). Chi-square test and Fisher exact test used to compare between categorical variables where compare between continuous variables by t-test and ANOVA Test and a correlation coefficient test was used to show the association between scores; a two-tailed  $p < 0.05$  was considered statistically significant. All analyses were performed with IBM SPSS 20.0 software.

### Results:

**Table (1): Frequency and percentages distribution of demographic data for post thyroidectomy patients in both groups (n=60).**

	Study group (n=30)		Control group (n=30)		Test of sig.	P. value
	N	%	n	%		
<b>Age</b>						
18> 30	5	16.6	2	6.7	1.97	0.741
30>40	12	40.0	14	46.6		
40>50	9	30.0	11	36.7		
50>60	2	6.7	1	3.3		
60- 65	2	6.7	2	6.7		
<b>Mean±SD(range)</b>	<b>37.74±10.60(18.61)</b>		<b>41.37±9.03(26.64)</b>		<b>T=-1.35</b>	<b>0.131</b>
<b>Gender</b>						
Male	12	40.0	9	30.0	0.65	0.589
Female	18	60.0	21	70.0		
<b>Marital status</b>						
Single	5	16.6	2	6.7	4.55	0.207
Married	15	50.0	21	70.0		
Divorced	2	6.7	3	10.0		
Widow	8	26.7	4	13.3		
<b>Residence</b>						
Urban	9	30.0	7	23.3	0.55	0.771
Rural	21	70.0	23	76.7		
<b>Educational level</b>						
Illiterate	17	56.7	20	66.7	4.78	0.188
Primary school	3	10.0	5	16.6		
Secondary school	6	20.0	3	10.0		
University & higher education	4	13.3	2	6.7		
<b>Occupation</b>						
Employer	9	30.0	4	13.3	3.18	0.364
House wife	12	40.0	17	56.7		
Not work	7	23.3	8	26.7		
Retired	2	6.7	1	3.3		

*Chi square test for qualitative data between the two groups and Fisher's exact test (2×2 variables) was conducted between demographic data between study and control groups.*

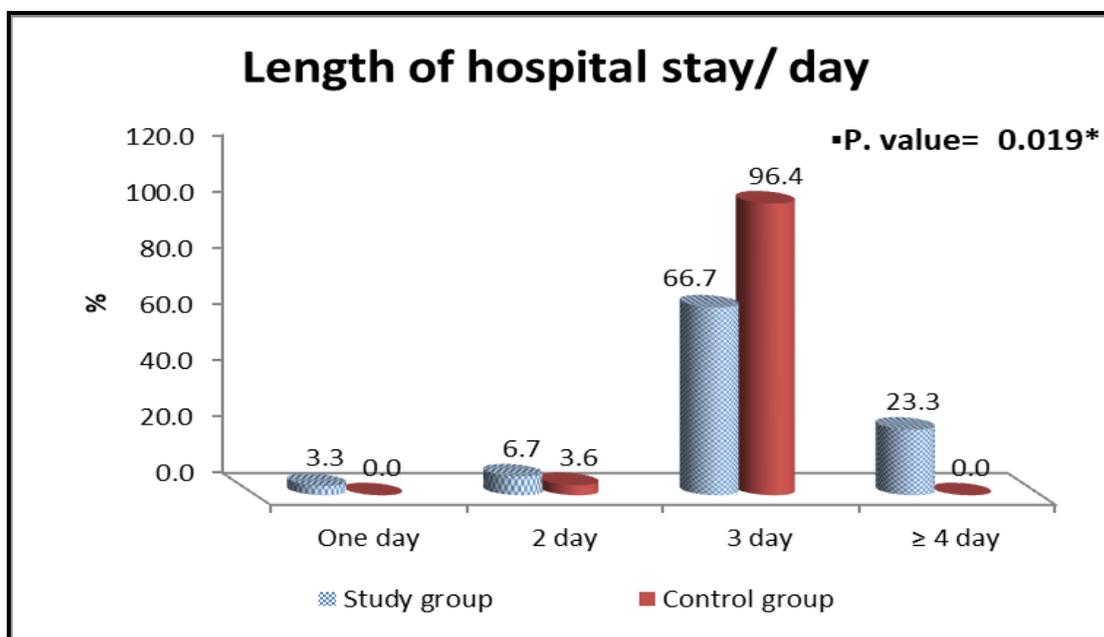


Figure (2): Length of hospital stay for study and control groups.

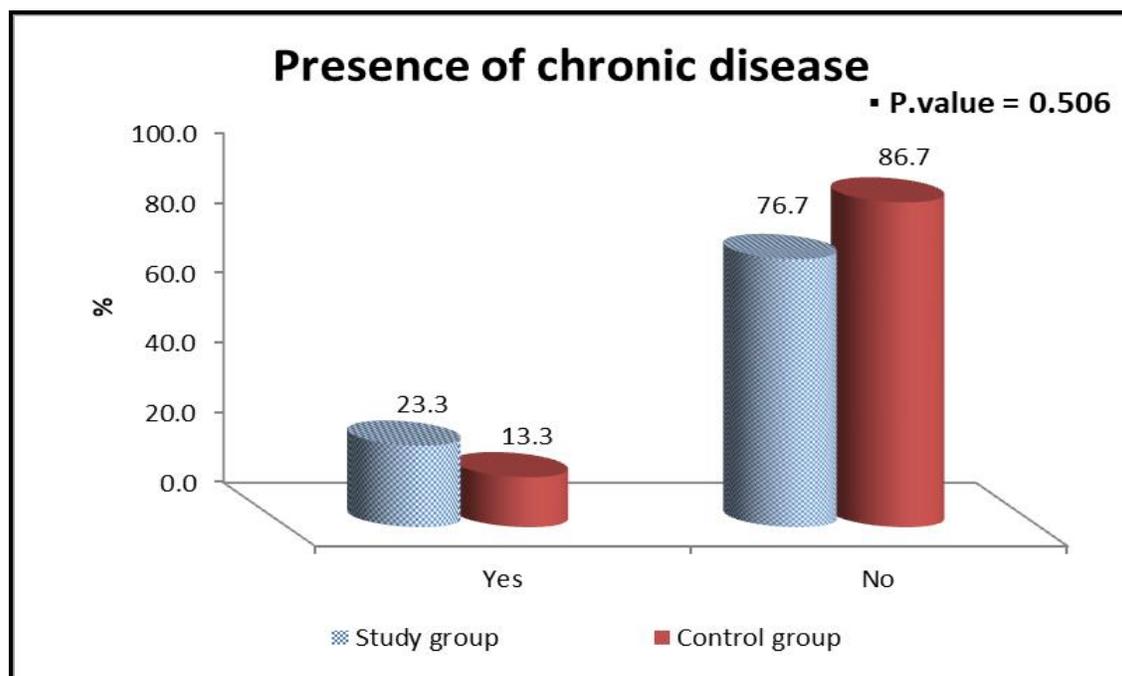


Figure (3): Presence of chronic diseases among study and control groups.

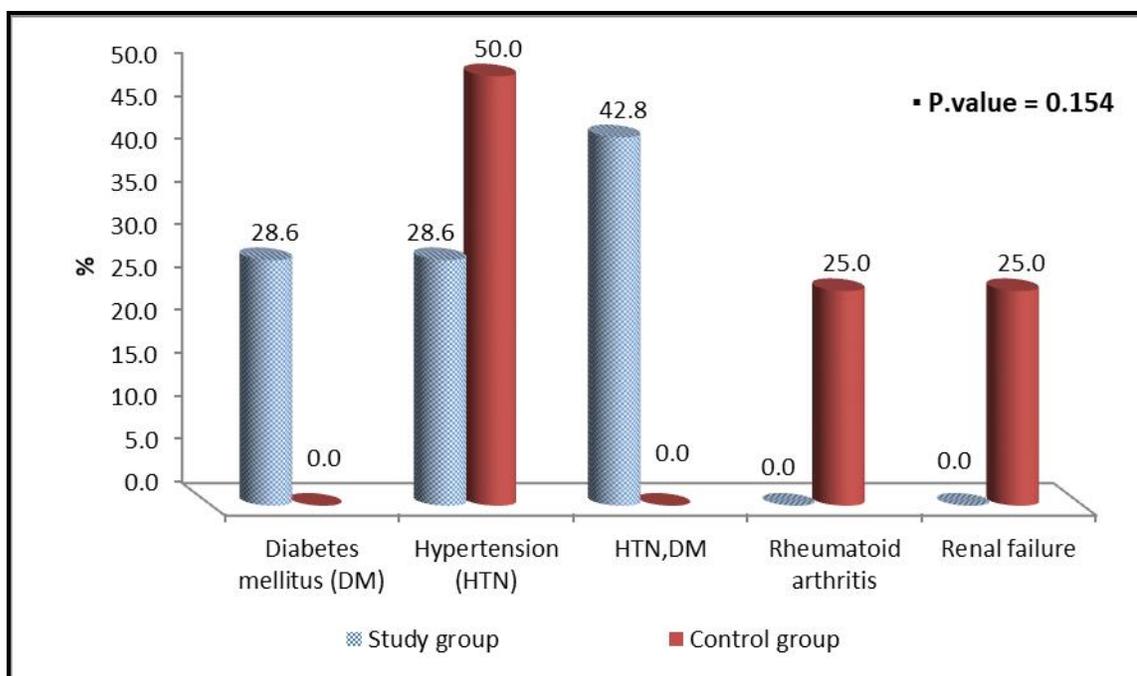


Figure (4): Type of chronic diseases among study and control groups.

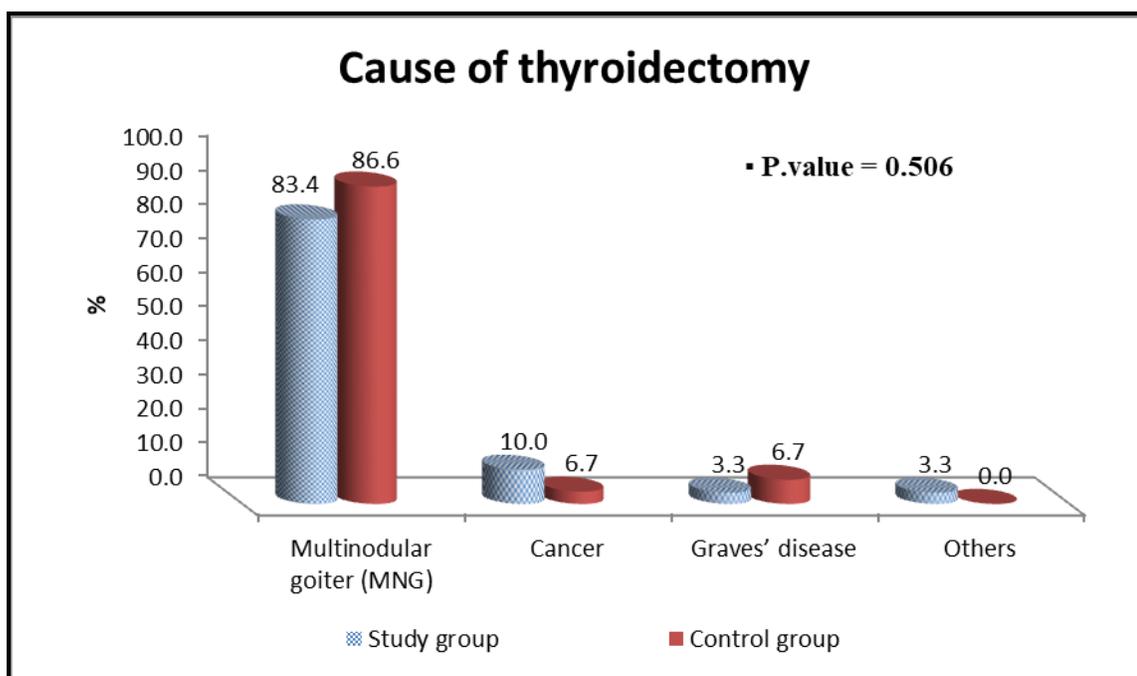


Figure (5): Cause of thyroidectomy among study and control groups.

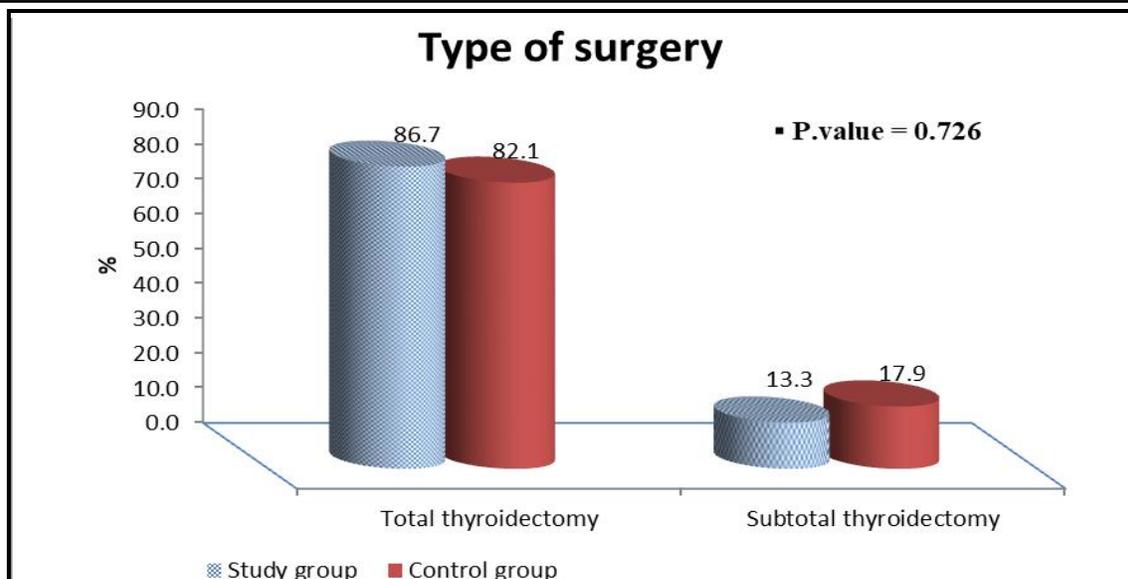


Figure (6): Type of thyroidectomy among study and control groups.

Table (2): Comparison between study and control groups related to wound adhesion based on the patient and observer scar assessment scale during three phases (n=60).

Patient and observer scar assessment scale	Group	one week post operatively	Test Used	After 2 week	Test Used	After 4 week	Test Used
		Mean ± SD		Mean± D		Mean ± SD	
<b>Observer component</b>							
Vascularization	Study	5.93±1.84	T=0.07	4.27±1.53	T=-4.56	2.57±1.04	T=-8.58
	Control	5.9±1.56	P=0.940	6.37±2.01	P<0.001**	6.9±2.56	P<0.001**
Pigmentation	Study	6.03±1.85	T=0.22	4±1.49	T=-5.02	2.47±0.9	T=-8.66
	Control	5.93±1.57	P=0.822	6.3±2.02	P<0.001**	6.73±2.55	P<0.001**
Thickness	Study	5.87±2.06	T= -0.13	4.1±1.45	T=-4.45	2.57±0.9	T=-9.98
	Control	5.93±1.82	P=0.895	6.23±2.13	P<0.001**	6.73±2.38	P<0.001**
Relief	Study	5.83±1.6	T=0.66	4.37±1.19	T=-3.60	2.47±0.86	T=-9.70
	Control	5.57±1.52	P=0.511	5.97±2.13	P=0.001**	6.7±2.23	P<0.001**
Pliability	Study	5.93±1.89	T=67	4.3±1.53	T=-3.77	2.23±0.97	T=-9.46
	Control	5.63±1.59	P=0.508	6.13±2.18	P<0.001**	6.63±2.36	P<0.001**
Surface area	Study	6.03±1.69	T=1.15	4.13±1.38	T=-4.18	2±0.87	T=-9.53
	Control	5.57±1.45	P=0.257	6.1±2.17	P<0.001**	6.67±2.54	P<0.001**
<b>Overall Opinion of the Observer (=60)</b>	Study	35.62±10.93	T=0.45	25.17±8.57	T=-4.45	14.31±5.54	T=-9.46
	Control	34.53±9.51	P=0.658	37.1±12.64	P<0.001**	40.36±14.62	P<0.001**
<b>Patient component</b>							
Is the scar painful?	Study	5.6±1.94	T=0.21	3.97±1.33	T=-6.06	2.2±1	T=-9.86
	Control	5.5±1.66	P=0.831	6.57±1.94	P<0.001**	6.9±2.41	P<0.001**
Is the scar itching?	Study	5.53±1.57	T=0.00	4.07±1.17	T=-5.38	2.23±0.86	T=-10.04
	Control	5.53±1.72	P=1.000	6.3±1.95	P<0.001**	6.9±2.4	P<0.001**
Is the color of scar different?	Study	5.67±1.71	T=0.53	4±1.17	T=-4.57	2.17±0.91	T=-8.97
	Control	5.43±1.7	P=0.597	5.97±2.04	P<0.001**	6.57±2.53	0.000
Is the scar more stiff?	Study	5.9±1.71	T=1.24	4.1±1.21	T=-4.30	2.13±0.78	T=-9.05
	Control	5.37±1.63	P=0.221	5.97±2.04	P<0.001**	6.57±2.57	P<0.001**
Is the thickness of scar different?	Study	5.67±1.71	T=0.84	4.03±1.19	T=-4.52	2.07±0.78	T=-9.29
	Control	5.3±1.66	P=0.403	6±2.07	P<0.001**	6.6±2.55	P<0.001**
Is the scar irregular?	Study	5.63±1.71	T=0.79	3.87±1.14	T=-5.18	2.07±0.83	T=-9.99
	Control	5.3±1.56	P=0.433	6.17±2.15	P<0.001**	6.83±2.48	P<0.001**
<b>Overall Opinion of the Patient Maximum=60</b>	Study	34±10.35	T=0.62	24.04±7.21	T=-5.15	12.67±5.16	T=-9.75
	Control	32.43±9.93	P=0.537	36.98±12.19	P<0.001**	40.37±14.94	P<0.001**
<b>Total patient and observer score (Max=120)</b>	Study	69.62±21.28	T=0.56	49.21±15.78	T=-5.00	26.98±10.7	T=-9.86
	Control	66.96±19.44	P=0.575	74.08±24.83	P<0.001**	80.73±29.56	P<0.001**

Independent T-test quantitative data between the two groups

\*Significant level at P value < 0.05

\*\*Significant level at P value < 0.01

**Table (3): Comparison between study and control groups related to voice changes based on voice handicap index (VHI-10) during three phases (n=60).**

Voice Handicap Index items	Max Score	One week post operatively			After 2 weeks			After 4 weeks		
		Study	Control	T	Study	Control	T	Study	Control	T
		Mean±SD	Mean±SD	P.V	Mean±SD	Mean±SD	P. value	Mean±SD	Mean±SD	P. value
Functional	20	11.7±3.96	11.77±2.2	-0.08 .936	6±2.32	13.6±2.11	-13.27 <0.001**	4.5±2	12.37±2.98	-12.02 <0.001**
Physical	12	7.23±1.99	7.13±1.63	0.21 0.833	4.43±1.48	8.67±1.6	-10.63 <0.001**	2.5±1.17	7.5±2.1	-11.41 <0.001**
Emotional	8	4.6±1.52	4.9±1.16	-0.86 0.393	3.13±1.53	5.7±1.02	-7.66 0.000**	1.53±0.86	5.17±1.34	-12.49 <0.001**
Total Voice Handicap Index score	40	23.53±7.47	22.9±4.99	-0.18 0.861	13.56±5.33	27.97±4.73	-12.37 <0.001**	8.53±4.03	25.04±6.37	-13.04 <0.001**

Independent T-test quantitative data between the two groups \*\*Significant level at P value < 0.01

**Table (4): Comparison between compliance rates for applying of neck exercises and wound massage among study group patients after 2&4 weeks postoperatively (n=30).**

Compliance	Target	After 2 weeks		After 4 weeks		T	P. value
		Mean±SD	%	Mean±SD	%		
<b>Compliance rates for applying of neck exercises</b>							
Frequency of exercises practiced per day	3	2.3±0.53	76.67	2.63±0.49	87.78	-3.80	0.001**
Number of practiced exercises	8	5.67±1.4	70.83	7.03±0.96	87.92	-8.80	<0.001**
<b>Compliance rates for applying of massage</b>							
Frequency of applying massage per day	3	2.2±0.55	73.33	2.43±0.5	81.11	-2.97	0.006
Time of Massage(minutes)	10	7.63±1.16	76.33	8.9±1.06	89.00	-8.83	<0.001**

Paired-samples t- test quantitative data between the two means \*\*Significant level at P value < 0.01

**Table (5): Correlation Co-efficient between study group wound adhesion and compliance with applying neck exercises & wound massage after 2 & 4 weeks.**

Compliance	Overall Opinion of the Patient			
	After 2 week		After 4 week	
	R	P	R	P
	Frequency of exercises practice per day	-0.416 <sup>*</sup>	0.022	-0.301
Number of practiced exercises	-0.695 <sup>**</sup>	0.000	-0.479 <sup>**</sup>	0.007
Frequency of applying massage per day	-0.621 <sup>**</sup>	0.000	-0.440 <sup>*</sup>	0.015
Time of Massage per day	-0.856 <sup>**</sup>	0.000	-0.431 <sup>*</sup>	0.017
	Overall Opinion of the Observers			
	After 2 week		After 4 week	
	R	P	R	P
	Frequency of exercises practice per day	-0.376 <sup>*</sup>	0.041	-0.488 <sup>**</sup>
Number of practiced exercises	-0.648 <sup>**</sup>	0.000	-0.621 <sup>**</sup>	0.000
Frequency of applying massage per day	-0.645 <sup>**</sup>	0.000	-0.458 <sup>*</sup>	0.011
Time of Massage per day	-0.856 <sup>**</sup>	0.000	-0.574 <sup>**</sup>	0.001

\*Statistically Significant Correlations at P. value <0.05 \*\*Statistically Significant Correlations at P .value <0.01

**Table (6): Correlation Co-efficient between study group voice changes and compliance with applying neck exercises and wound massage after 2 & 4 weeks**

Compliance	Voice Handicap Index			
	After 2 week		After 4 week	
	R	P	R	P
	Frequency of exercises practice per day	-0.340	0.066	-0.474 <sup>**</sup>
Number of practiced exercises	-0.649 <sup>**</sup>	0.000	-0.586 <sup>**</sup>	0.001
Frequency of applying massage per day	-0.512 <sup>**</sup>	0.004	-0.384 <sup>*</sup>	0.036
Time of Massage per day	-0.804 <sup>**</sup>	0.000	-0.542 <sup>**</sup>	0.002

\*Statistically Significant Correlations at P. value <0.05 \*\*Statistically Significant Correlations at P .value <0.01

**Table (1):** Illustrates that highest percentage of patients in both the study and control groups, their age ranged from 30 to 40 years with a mean age of (37.74±10.60 and 41.37±9.03 respectively), and were housewives (40.0% and 56.7%) respectively. It was found that there was a predominance of females in both groups (60.0% and 70.0%, respectively). Regarding marital status, half of patients in study group (50.0%) and nearly three-quarters of patients in control group (70.0%) were married. The majority of patients in both groups were residents of rural areas (70.0% and 76.7%, respectively). Among the recruited patients, slightly more than half in the study group (56.7%) and two-thirds in the control group (66.7%) were illiterate. There was no statistically significant difference in demographic variables related to the group with a value (P = 0.741, 0.589, 0.207, 0.771, 0.188, 0.364).

**Figure (2):** Shows the mean length of hospital stay for both the study and control groups; the highest percentage of patients in both groups stayed three days in the hospital (66.7% and 96.4%), respectively, with a mean of (3.10±0.66) days for the study group and (2.97±0.18) days for the control group.

**Figure (3):** Represents the presence of chronic diseases, and it clarifies that highest percentage of patients in both the study and control groups didn't have any chronic diseases (76.7% and 86.7%), respectively.

**Figure (4):** Shows that highest percentages of patients in the study group who had chronic diseases suffered from hypertension and diabetes mellitus, and half of the control group had hypertension.

**Figure (5):** Clarifies that multinodular goiter was the cause of thyroidectomy in the majority of patients in the study and control groups (83.4% and 86.6%), respectively.

**Figure (6):** Shows that the majority of patients in the study and control groups underwent total thyroidectomy (86.7% and 82.1%), respectively.

**Table (2):** Displays that there were no statistically significant differences between the study and control groups regarding wound adhesion in variables of patient and observer scar scale before applying neck exercises and wound massage (one week postoperatively) (P-value 0.575). While there were highly statistically significant differences between both groups after neck exercises and wound massage (2 and 4 weeks postoperatively) (P-value<0.001\*\*).

**Table (3):** Clarifies that there were no statistically significant differences between the study and control groups regarding voice changes based on the voice handicap index before applying of neck exercises and massage (one week postoperatively) (P-value 0.861). While there were highly statistically significant differences between both groups after applying neck

exercises and wound massage (2 and 4 weeks postoperatively) (P-value<0.001\*\*).

**Table (4):** Reflects a highly statistically significant difference in compliance of performing exercises: the mean frequency of exercise practiced per day was 2.3±0.53 (at 2 weeks) and 2.63±0.49 after 4 weeks with (P -0.001), and the mean number of exercises practiced per day was 5.67±1.4 after 2 weeks and 7.03±0.96 after 4 weeks. There was no significant difference in the frequency of applying massage per day, while there was a highly statistically significant difference regarding the time of applying wound massage with p <0.001.

**Table (5):** shows that there was a significant positive correlation between compliance with applying neck exercises and wound massage and wound adhesion after 2 and 4 weeks.

**Table (6):** Shows that there was a significant positive correlation between compliance with applying neck exercises and wound massage and voice changes after 2 and 4 weeks.

## Discussion:

After thyroid surgery, voice changes are frequent complaints that have a significant impact on quality of life. With post-surgical rates ranging from 2.3% to 26%, RLN damage has been conclusively identified as the cause. After thyroid surgery, some people exhibit voice changes, while there is no evident nerve damage. Other than RLN, a number of pathophysiologic reasons for voice alteration have been hypothesized, such as wound fibrosis or adhesion (Ryu et al., 2022). Neck exercises decrease pain and discomfort in the muscles and enhance functioning, range of motion, and neuromuscular coordination (Magdy et al., 2022). So the present study investigated the effect of teaching protocol of neck exercises and wound massage on wound adhesion and voice changes among post thyroidectomy patients.

According to the present study's analysis of demographic data, the majority of patients in both the study and control groups were between the ages of 30 and 40, with a mean age of 37.74±10.60 and 41.37±9.03, respectively. This result was in line with that of El Shafaey et al., (2022), who reported that the mean ages of the patients in study and control groups were (35±25.99 and 40±11.67) respectively. Additionally Abd Elazeem et al., (2020) agreed with the findings of the current study who reported that the majority of the studied patients in both the study and control groups were between the ages of 30 and 40 years. Thyroid disorders are very prevalent in middle-aged people, according to Castello and Caputo., (2019), who also confirmed this finding from the literature review.

**As regards gender**, the current study made clear that females made up the majority in both groups. This result was consistent with the findings of **El Shafaey et al., (2022)**, who noted that female patients made up the majority of thyroidectomy patients. These findings were supported by a review of the literature (**Sruthy, 2023**), which showed that women are substantially more likely than men or children to have thyroid abnormalities, making gender one of the unchanging risk factors for thyroid diseases.

According to the results of the current study, half of the patients in the study group and almost three-quarters of the patients in the control group were married. This was in agreement with **Mohammed et al., (2023)**, who noted that the majority of patients in the study and control groups were married with regard to marital status.

**Regarding residence**, the current study reported that the majority of patients in both groups lived in rural areas. This was supported by **Hashem et al., (2018)**, who conducted a study titled as "Effect of Designed Nursing Guidelines on Minimizing Postoperative Complications for Patients Undergoing Thyroidectomy" and reported the same results by revealing that the majority of both groups were from rural areas.

**Regarding level of education**; slightly more than half of the patients in study group and two-thirds of the patients in control group were illiterate; this finding was accepted by **Ali et al., (2020)**, who noted that the majority of the studied patients were illiterate. This finding of the present study contradicts **Ibrahim et al., (2019)**, who discovered that more than half of the studied patients were educated. From the researchers' point of view, it's possible that the nature and community traits of the study subjects account for the variations in the findings.

**According to the current study's findings regarding occupation**, the majority of patients in both study and control groups were housewives. This result might have been influenced by the fact that the majority of the patients in the study were females. This finding is supported by the reports of **Alhusami et al., (2019)** and **Gezer & Arslan (2019)** who clarified that the majority of the participants in the study group and control group were housewives. In this study, there was no statistically significant difference between demographic variables related to both groups this was in consistence with **Thorsen et al., (2022)** who stated that there was no statistically significant difference regarding demographic data of patients.

**As regards medical data**, the current study clarified that the mean hospital stay was  $(3.10 \pm 0.66)$  days for the study group and  $(2.97 \pm 0.18)$  days for the control group. This was in line with **Altinbas & Gürsoy's**

**(2023)** declaration that patients were discharged from the hospital where the study was conducted at the earliest 2 days after thyroidectomy in accordance with the hospital protocol.

According to the current study, the majority of patients in both the study and control groups did not have any chronic diseases. The highest percentages of patients in the study group who had chronic diseases, suffered from hypertension and diabetes mellitus, while only half of the patients in the control group had hypertension. This was in agreement with **Khamis et al., (2021)**, who noted that the majority of patients in the study and control groups had no associated disorders.

The previous finding of the current study was also supported by **Abo Shehata et al., (2020)**, who explained that the majority of patients in both groups had hypertension and approximately one-third of the study group and one-quarter of the control group had diabetes mellitus. Also, this result was in line with the findings of **Al-Geffari et al., (2013)**, who noted that diabetic patients are prone to various forms of thyroid dysfunction.

**According to the results of the current study**; the majority of patients in both the study and control groups underwent total thyroidectomy due to multinodular goiter. **Altinbas & Gürsoy (2023)** confirmed this finding, as they reported that the majority of patients underwent surgery after receiving a diagnosis of multinodular goiter. Both **Abd Elazeem et al., (2020)** & **Turkmen et al., (2020)** reported that the majority of patients underwent total thyroidectomy surgery as a result of multinodular goiter, which is consistent with the same finding. In contrast to the current findings, **Thorsen et al., (2022)** reported that the majority of patients underwent hemithyroidectomy. From the researchers' point of view, this may be attributed to different nature and study sample.

**Regarding wound adhesion based on the patient and observer scar assessment scale**, this study displayed that there were no statistically significant differences between the study and control groups regarding wound adhesion in variables of the patient and observer scale before applying the teaching protocol of neck exercise and wound massage (one week postoperatively). While there were highly statistically significant differences between both groups after applying the teaching protocol of neck exercise and wound massage (2 and 4 weeks postoperatively), This was in accordance with **Turkmen et al., (2020)**, who performed head-neck exercises on thyroidectomy patients and noticed the average postoperative POSAS score showed a significant difference between the ratings provided by the participants of the experimental and control

groups regarding the healing of wounds one day after surgery and one week after surgery.

This is also consistent with the research done by **Jang et al., (2014)**, who confirmed the same result and explained that the early exercise group's range of motion had improved and the degree of surgical wound adhesion had been significantly reduced. According to the same findings, **Lee et al. (2018)** reported that the experimental group recovered from surgical adhesion significantly better than the control group, and they explained that wound massage had an effect on the release of adhesion between the larynx and strap muscles/subcutaneous tissues. They also calculated the wound adhesion grade and noted that the wound scar in the control group retracted at 4 weeks and was only marginally diminished at 12 weeks. However, the scar from the experimental group's wound decreased.

According to the review of the literature, this was in accordance with the previous finding of the current study which explained the technique and procedure of neck exercises and wound massaging reduced wound adhesions by increasing the circulation to that area, which in turn causes the adhesion to be destroyed and this can help with the postoperative healing process (**Hasan & Al Dabbagh 2021**). Additionally, some researchers found that massage technique can increase the extensibility of soft tissues (**Ault et al., 2018**).

**Regarding voice changes**, historically, voice changes following surgical removal of the thyroid have been attributed to iatrogenic injury to the laryngeal nerves during the thyroidectomy (**Hong et al., 2017 & Ault et al., 2018**). Recurrent laryngeal nerve injury following thyroid surgery is a significant complication. However, even when the laryngeal nerves are functioning properly, voice changes have been documented. Surgery trauma, endotracheal intubation, arytenoid trauma, or larynx fixation with strap muscles or subcutaneous tissue have all been implicated in these circumstances as causes of voice alterations (**Lee et al., 2018**).

According to the study's findings, there were no statistically significant differences between the study and control groups regarding voice changes based on the voice handicap index before applying the neck exercises and wound massage teaching protocol (one week postoperatively), but there were significant differences between the two groups (2 and 4 weeks postoperatively) after doing so. In this regard, **Lee et al. (2018)** reported that wound massage decreased subjective voice discomfort, clarifying that subjective voice discomfort evaluation was carried out for patients postoperatively and demonstrating that a significant difference in voice impairment score (VIS) between the 2 groups was documented, which

supported current study findings. Also, this result was consistent with research by **Thorsen et al. (2022)**, who found that the VHI-10 was similar in both the study group and the control group at baseline. In contrast, they added that there was no significant difference between the two groups' subjective voice function at one, two, four, and three months following surgery when comparing these results to baseline. From the researchers' point of view, this could be attributed to instructions given to patients and insurance's compliance with them.

**Regarding compliance rates for the performance of neck exercises and massage**, this study reflects a highly statistically significant difference in the compliance of study group patients to perform neck exercises and wound massage. There was no significant difference in the frequency of performing massage per day, while there was a highly statistically significant difference regarding the time of performing massage. This finding was congruent with **Hassan et al. (2012)**, who reported that there was a statistically significant difference among the studied sample during three months in relation to medication, lifestyle, and overall compliance. From the researchers' point of view, possible explanation might be due to the effect of instructions given by researchers or, the presence of a booklet and follow up with telephone calls.

According to **Lee et al. (2018)** in the same context, the compliance rate for wound massage was eighty eight percent for average massages per day and eight percent for massage minutes. **Hasan & Al Dabbagh (2021)**, who noted that the majority of patients had high wound massage compliance percentages for average massages per day and for the length of massage, also support this finding. They also showed that neck massage technique can be a tool and a cause for the release of wound adhesions, giving the larynx a space for its movement to be much more smoothly. By raising the voice pitch and eliminating the neck-pulling sensation, that technique may also enhance phonation.

**Regarding correlation between wound adhesion and compliance with exercises and massage for the study group**; the current study demonstrates that there was a significant positive correlation between compliance with exercises, massage and wound adhesion in patients post-thyroidectomy after 2 and 4 weeks from applying the teaching protocol of neck exercises and wound massage. This was supported by a literature review that stated that wound massage might be able to reduce adhesions by increasing circulation, which can lead to the breakdown or release of the adhesion, thus aiding the healing process after surgery and extensibility of soft tissues (**Ault et al., 2018 & Hasan and Al Dabbagh 2021**).

Regarding the correlation between voice changes and compliance with exercises and massage for the study group after 2 and 4 weeks of using the neck exercises and wound massage teaching protocol; this study demonstrates that there was a highly significant positive correlation between voice changes and compliance with exercises and massage after 2 and 4 weeks of using the neck exercises and wound massage teaching protocol. According to **Hasan & Al Dabbagh (2021)**, who also supported the possibility that phonation and voice changes, as well as neck discomfort, may be related to total thyroidectomy procedures, releasing wound adhesions through adherence to exercises and massage may be crucial for improving the larynx's vertical movement flexibility and shortening patients' recovery times. In the same context, **Abo Shehata et al. (2020)** reported that the study group's neck movement, compared to the control group, is greatly improved by patient compliance with range of motion exercises, which also significantly reduces discomfort. A correlation between compliance and neck pain, discomfort, and disability was also revealed in their study's results.

### Conclusion:

Based on the findings of the current study, it can be concluded that implementation of teaching protocol of neck exercises and wound massage for patients who had undergone thyroidectomy significantly reduced wound adhesion in the study group compared to the control group. Additionally, the patients in study group experienced voice changes at a lower rate than the control group during the second and fourth weeks from implementing teaching protocol of neck exercises and wound massage.

### Recommendations:

From the previously mentioned conclusion, the following recommendations could be inferred:

- The neck exercises and wound massage are recommended to be an integral part of the pre-operative nursing teaching for patients undergoing thyroidectomy.
- A simple illustrated booklet for thyroidectomy patients that includes all therapeutic instructions as well as exercises and techniques of wound massage should be available at the surgical wards as a reference for nurses to know how to deal with thyroidectomy patients and help in increasing patient awareness and understanding, thus increasing patient compliance, which in turn reduces post-thyroidectomy wound adhesion and voice changes.
- The study should be repeated with a larger probability sample collected from other geographic

locations to generate more results that may be used broadly.

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The authors declare that they have no conflict of interest.

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