

# Study of the Effect of Preoperative Dexamethasone before Total Thyroidectomy on Postoperative Nausea, Vomiting, Pain and Voice Dysfunction

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## ABSTRACT

The study was conducted in Ain Shams University Hospitals. It was a prospective randomized comparative study. Based on the results and data compared between the two groups preoperative dose of dexamethasone is recommended prior to total thyroidectomy operations, due to its beneficial effect in diminishing probability of occurrence of postoperative voice changes, pain and dyspepsia.

**Key words:**Thyroid, Dexamethasone, cartilage, trachea, chemotherapy.

## INTRODUCTION

The thyroid is the first endocrine gland to develop in the embryo. It begins to form about 24 days after fertilization from a median endodermal thickening in the floor of the primordial pharynx. This thickening soon forms a small out-pouching 'the thyroid primordium.

Most recently, various new instruments and approaches including video-assisted thyroidectomy and robot-assisted thyroidectomy have emerged for the various indications of total thyroidectomy which includes; primary hyperthyroidism after failure of medical treatment, Secondary toxic goiters, Simple multinodular goiters with cosmetic dysfunction or pressure manifestations, thyroiditis and thyroid malignancies.

Hoarseness is a common complication of thyroidectomy which can be attributed to many factors including surgical error, intubation injury and non-surgical causes, such as psychological reasons. Furthermore, many patients have pre-existing hoarseness that may either improve or persist after surgery.

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As compared with procedures such as cervical spine surgery, mediastinum surgery, esophagectomy and endarterectomy, thyroidectomy appears to be a procedure with a relatively low risk for hoarseness.

Guidelines for management of post thyroidectomy voice changes were developed using an explicit and transparent protocol for creating actionable statements based on supporting evidence and the associated balance of benefit and harm. These Guidelines are intended to produce optimal health outcomes for patients, minimize harm, and reduce inappropriate variations in clinical care The guidelines development panel was comprised of representatives from the fields of otolaryngology, laryngology, head and neck surgery, nursing, speech-language pathology, endocrinology, internal medicine, general surgery, anesthesiology, and consumer advocacy.

Dexamethasone, an adrenocortical steroid is regularly used against chemotherapy-induced nausea and has shown efficacy against postoperative nausea and vomiting in several studies, Preoperative application of steroids has also reduced postoperative swelling and pain after oral, head and neck surgery, The reduction of pain by steroids has been attributed to the suppression of the release of inflammatory mediators that induce hyperalgesia, however its effect on voice dysfunction has been under study.

## PATIENTS AND METHODS

The study was conducted in Ain Shams University Hospitals. It was a prospective randomized comparative study.

The study included patients suffering from thyroid diseases in whom total thyroidectomy was indicated. Patients enrolled in the study fulfilled the following criteria:

#### **Inclusion criteria:**

- Thyroid disease to which total thyroidectomy is indicated (e.g. Multinodular goiter with cosmetic or pressure symptoms, thyroiditis).
- Age: more than years.
- No known malignant thyroid disease.
- Normal preoperative voice analysis: normal voice recording and aerodynamics
- No previous neck or thyroid surgery.
- All the patients should sign the informed consent

#### **Exclusion Criteria:**

- The following patients will be excluded from the study:
- Patients with chronic pain disorder.
- Insulin dependent diabetes mellitus.
- History of chronic nausea or vomiting due to other medical conditions.
- Pregnancy.
- Age < years.
- Known malignant thyroid disease.
- Patient that undergone previous thyroid or neck surgery.
- Abnormal preoperative voice analysis.
- Patients with previous voice disturbance or a voice visual analog scale> .

Patients not fit for anesthesia or surgery (e.g. heart failure, chronic renal failure, respiratory failure).

Included patients will be randomly divided using closed envelopment method into two groups: -

**Group A:** (patients) will receive preoperative prophylactic Dexamethasone.

**Group B:** (patients) will not receive preoperative prophylactic dose of Dexamethasone.

#### **Preoperative workup: -History taking:**

- Occupational history.
- Personal habits (smoking heavy exercise ...)
- History of previous operations (type, time, place, complications).
- Other systems review (urological, cardio-vascular system, respiratory, liver diseases, or history of DM).
- Medications.
- Presenting indication for total thyroidectomy. –

#### **Examination:**

A-General: full general examination must be done, focusing on:

- Vital data.

- Complexion (pallor, jaundice).
- Cardio-vascular fitness.
- Respiratory fitness.

B. Local: full Neck examination focused on:

Size of the gland.

Whole gland or single lobe affected.

Presence or absence of cervical lymphadenopathy.

Presence of retrosternal extension.

#### **Investigations:**

A) Laboratory:

General pre-operative investigations for all the patients include:

- Full blood count.
- Coagulation profile.
- Liver function tests.
- Renal function tests.
- Random blood sugar.
- Serum electrolytes.
- Thyroid function tests.

B) Cardio-respiratory investigations:

Patients will have preoperative assessment of their cardio-respiratory system according to their American society of Anesthesiologists classification.

C) Radiological:

All patients will have preoperative Chest X-Ray, neck Ultrasound.

#### **Specific investigations:**

Vocal cord and voice function evaluation by Direct laryngoscopy, rigid laryngoscopic examination degree or nasofibroscopy can be used if failed direct laryngoscopy.

##### **ii. Voice Recording:**

Intonation was recorded preoperatively and at the same postoperative time points as nausea and pain.

##### **iii. Aerodynamics (F.Jitter and Shimmer):**

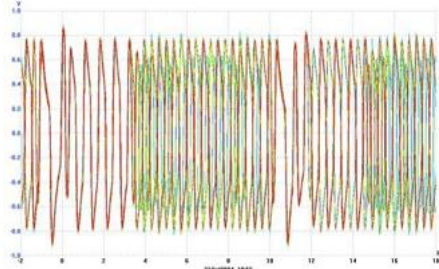
The overall objective vocal quality of the subjects was measured by means of Dysphonia Severity Index (DSI) which is designed to establish an objective and quantitative correlate of perceived vocal quality it is based on the combination of the following set of voice measurements; fundamental frequency (F Hz), mean percent Jitter and shimmer. Jitter and shimmer are measures of the cycle-to-cycle variations of fundamental frequency and amplitude, respectively, which have been largely used for the description of pathological voice quality. Since they characterize some aspects concerning particular voices, it is a priori expected to find differences in the values of jitter and shimmer among speakers. Experiments performed with the Switchboard- I conversational speech database show that jitter and shimmer measurements give excellent results in speaker

verification as complementary features of spectral and prosodic parameters.

**Jitter measurements:**

It is measure of the cycle-to-cycle variations of fundamental frequency.

**Figure-1. Jitter and Shimmer measurement.**



Jitter (absolute) is the cycle-to-cycle variation of fundamental frequency, i.e. the average absolute difference between consecutive periods, expressed as:  $\frac{\sum |T_i - T_{i+1}|}{N}$  where  $T_i$  are the extracted F period lengths and  $N$  is the number of extracted F periods.

Jitter (relative) is the average absolute difference between consecutive periods, divided by the average period. It is expressed as a percentage:  $\frac{\sum |T_i - T_{i+1}|}{\sum T_i} \times 100$

Jitter (rap) is defined as the Relative Average Perturbation, the average absolute difference between a period and the average of it and its two neighbours, divided by the average period.

Jitter (ppq) is the five-point Period Perturbation Quotient, computed as the average absolute difference between a period and the average of it and its four closest neighbors, divided by the average period.

Shimmer (dB) is expressed as the variability of the peak-to-peak amplitude in decibels, i.e. the average absolute base- logarithm of the difference between the amplitudes of consecutive periods, multiplied by  $10 \log_{10}$ . Shimmer (dB) is  $10 \log_{10} \left( \frac{\sum |A_i - A_{i+1}|}{N} \right)$  where  $A_i$  are the extracted peak-to-peak amplitude data and  $N$  is the number of extracted fundamental frequency periods.

Shimmer (apq) is defined as the five-point Amplitude Perturbation Quotient, the average absolute difference between the amplitude of a period and the average of the amplitudes of it and its four closest neighbors, divided by the average amplitude.

Shimmer (apq) is expressed as the -point Amplitude Perturbation Quotient, the average absolute difference between the amplitude of a period and the average of the amplitudes of it and its ten closest neighbors, divided by the average amplitude.

**Statistical Methods:**

- Data were analyzed using SPSS ver. IBMincorporation.
- Numerical data were tested for normality with D'agostino-pearson test, normally distributed data were presented as mean  $\pm$  SD, and non-normally distributed data were presented as median (interquartile range).
- Categorical data were presented as number and percent of total.
- Comparative analysis of numerical data was done with unpaired student t test, or Mann-Whitney test deepening on normality of data.
- Comparative analysis of categorical data was done with Chi-square (X<sup>2</sup>), and Fisher exact test.
- Comparison of paired data was done with Paired sample t test, or Wilcoxon signed rank test, for parametric and non-parametric data respectively.
- Data were tabulated and graphically illustrated.

**RESULTS**

Our study was conducted on 100 patients with simple multinodular goiter, patients were randomized into 2 groups. The results are presented tables-1-10 and Figures 1-7.

Group-1: received Dexamethasone with induction of anesthesia (47 patients)

Group-2: didn't receive Dexamethasone (53 patients)

**Table-1. Baseline Aerodynamics**

	Mean $\pm$ SD	Range
Fundamental Frequency	216.9 $\pm$ 38.1	122.82 – 333.92
Jitter (%)	1.76 $\pm$ 1.1	0.45 – 5.52
Shimmer (%)	3.8 $\pm$ 1.97	1.7 – 11.3

**Table-2. Baseline voice recording**

		Frequen cy	Perce nt
Dysphonia	Normal	63	63
	Mild	30	30
	Moderate	7	7
Strained	Normal	90	90
	Mild	7	7
Leaky	Moderate	3	3
	Normal	80	80
	Mild	13	13
	Moderate	3	3
Irregular	Severe	4	4
	Normal	93	93
	Mild	4	4
	Moderate	3	3

**Table-3. Comparison between groups as regard baseline aerodynamic parameters**

	Dexamethasone				P Value
	Yes		No		
	Mean	SD	Mean	SD	
Fundamental frequency	225.6	37.5	208.8	38	0.242
Jitter	1.88	0.99	1.66	1.2	0.59
Shimmer (dB)	4.2	2.35	3.43	1.5	0.28

**Table-4. Comparison of fundamental frequency before and after operation, each group separately**

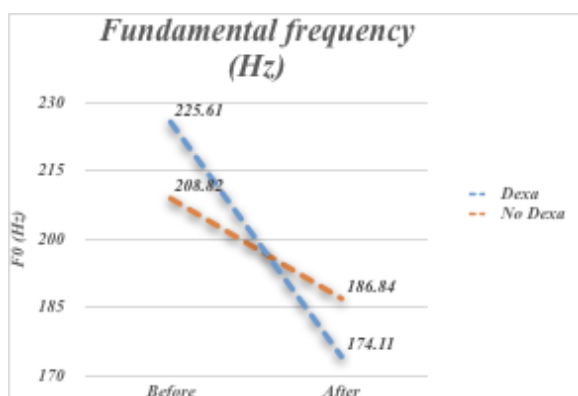
Fundamental frequency		Baseline		After		P Value
		Mean	SD	Mean	SD	
Dexamethasone therapy	No	208.82	38.11	186.84	53.80	<b>0.037</b>
	Yes	225.61	37.47	174.11	58.79	<b>0.007</b>

**Table-5. Comparison of Jitter before and after operation, each group separately**

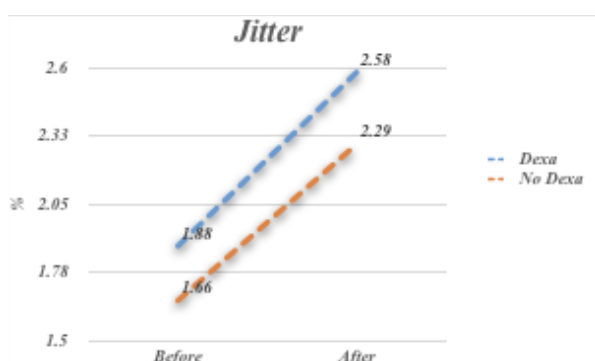
Jitter		Baseline		After		P Value
		Mean	SD	Mean	SD	
Dexamethasone therapy	No	1.66	1.20	2.29	1.93	0.226
	Yes	1.88	0.99	2.58	1.45	0.76

**Table-6. Comparison of Shimmer before and after operation, each group separately**

Shimmer		Baseline		After		P Value
		Mean	SD	Mean	SD	
Dexamethasone therapy	No	3.43	1.53	3.56	1.64	0.82
	Yes	4.2	2.35	5.9	3.2	0.77



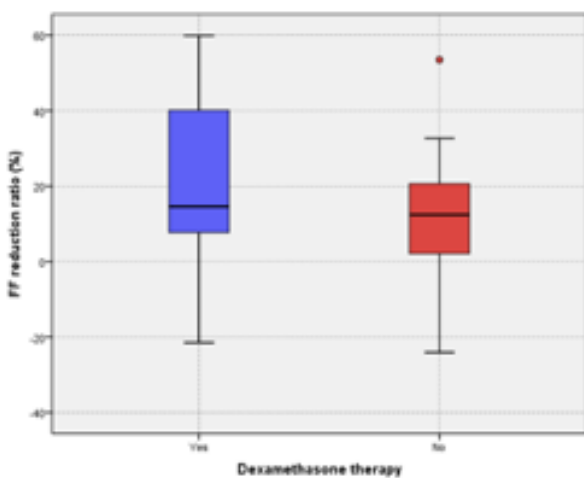
**Figure-2. Comparison of fundamental frequency, jitter and shimmer**



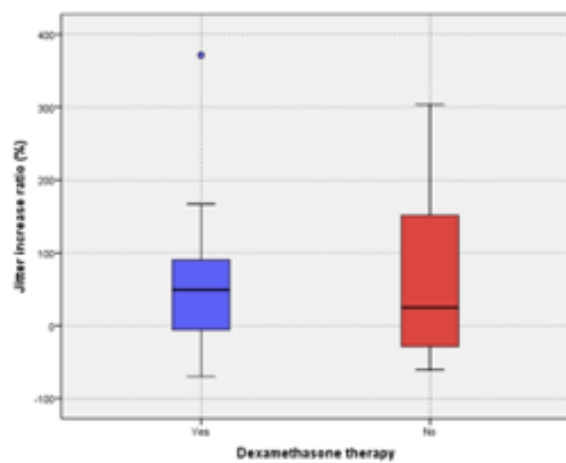
**Table-7. Comparison between groups as regard degree of change of aerodynamics**

	Dexamethasone therapy						P Value
	Yes			No			
	Median	IQR		Median	IQR		
	25 <sup>th</sup>	75 <sup>th</sup>		25 <sup>th</sup>	75 <sup>th</sup>		
<b>FF reduction ratio (%)</b>	14.64	7.76	40.13	12.43	1.15	22.09	0.201
<b>Jitter increase ratio (%)</b>	48.94	-5.84	90.38	24.86	-28.59	151.71	0.89
<b>Shimmer increase ratio (%)</b>	26.04	-47.37	397.60	5.71	-76.53	172.72	0.697

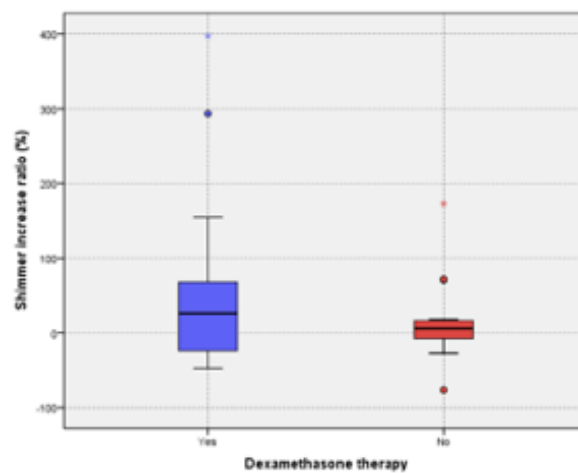
**Figure-3. Boxplot chart shows comparison between groups as regard FF reduction ratio**



**Figure-4. Boxplot chart shows comparison between groups as regard Jitter increase ratio**



**Figure-5. Boxplot chart shows comparison between groups as regard shimmer increase ratio**



**Table-8. Comparison between groups as regard baseline voice recording data**

		Dexamethasone therapy				P Value
		No (53)		Yes (47)		
		Count	%	Count	%	
Grade of Dysphonia	Normal	36	68.75%	27	57%	0.265
	Mild	10	18.75%	20	43%	
	Moderate	7	12.50%	0	0%	
Strained	Normal	50	94%	40	86%	0.209
	Mild	0	0%	7	14%	
	Moderate	3	6%	0	0%	
Leaky	Normal	43	81%	37	79%	0.453
	Mild	4	7%	10	21%	
	Moderate	3	6%	0	0%	
	Severe	3	6%	0	0%	
Irregular	Normal	50	94%	44	93%	0.724
	Mild	0	0%	3	7%	
	Moderate	3	6%	0	0%	

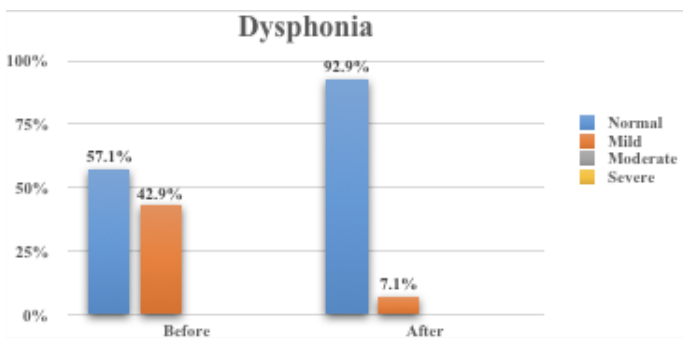
**Table-9. Comparison of voice recording parameters before and after operation in patients who didn't receive dexamethasone**

		No Dexamethasone (53)				P Value
		Before		After		
		Count	%	Count	%	
Grade of Dysphonia	Normal	36	68.8%	43	81.3%	0.18
	Mild	10	18.8%	7	12.5%	
	Moderate	7	12.5%	3	6.3%	
	Severe	0	0.0%	0	0.0%	
Strained	Normal	50	93.8%	46	87.5%	1
	Mild	0	0.0%	7	12.5%	
	Moderate	3	6.3%	0	0.0%	
	Severe	0	0.0%	0	0.0%	
Leaky	Normal	43	81.3%	50	93.8%	0.18
	Mild	4	6.3%	0	0.0%	
	Moderate	3	6.3%	0	0.0%	
	Severe	3	6.3%	3	6.3%	
Irregular	Normal	50	93.8%	50	93.8%	0.66
	Mild	0	0.0%	3	6.3%	
	Moderate	3	6.3%	0	0.0%	
	Severe	0	0.0%	0	0.0%	

**Table-10. Comparison of voice recording parameters before and after operation in patients who received dexamethasone**

		Dexamethasone (47)				P Value
		Before		After		
		Count	%	Count	%	
Grade of Dysphonia	Normal	27	57.1%	44	92.9%	0.025
	Mild	20	42.9%	3	7.1%	
	Moderate	0	0.0%	0	0.0%	
	Severe	0	0.0%	0	0.0%	
Strained	Normal	40	85.7%	47	100.0%	0.16
	Mild	7	14.3%	0	0.0%	
	Moderate	0	0.0%	0	0.0%	
	Severe	0	0.0%	0	0.0%	
Leaky	Normal	37	78.6%	44	92.9%	0.16
	Mild	10	21.4%	3	7.1%	
	Moderate	0	0.0%	0	0.0%	
	Severe	0	0.0%	0	0.0%	
Irregular	Normal	44	92.9%	44	92.9%	1
	Mild	3	7.1%	3	7.1%	
	Moderate	0	0.0%	0	0.0%	
	Severe	0	0.0%	0	0.0%	

**Figure-6. Dysphonia**



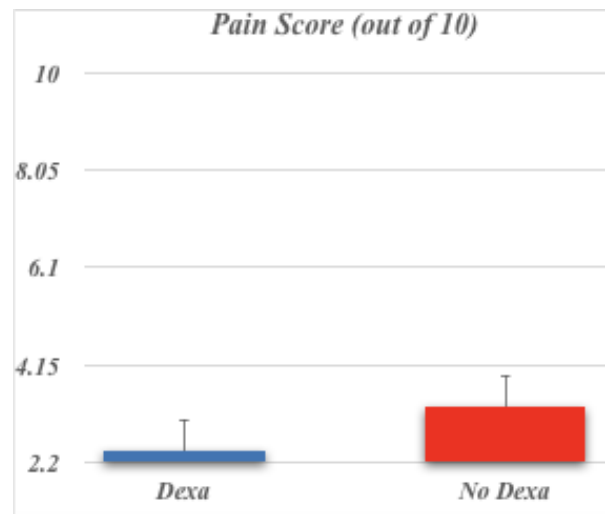
**Table-11. Comparison between groups as regard post-operative dyspepsia**

	Dexa (47)		No Dexa (53)		P Value
	Count	%	Count	%	
Nausea and Vomiting	0	0	7	12.5%	0.485

**Table-12. Comparison between groups as regard post-operative pain**

	Dexa (47)		No Dexa (53)		P Value
	Mean	SD	Mean	SD	
Pain	2.43	0.64	3.31	0.95	0.006

**Figure-7. Pain score**



**CONCLUSION**

Based on the results and data compared between the two groups preoperative dose of dexamethasone is recommended prior to total thyroidectomy operations, due to its beneficial effect in diminishing probability of occurrence of postoperative voice changes, pain and dyspepsia.

**Conflicts of Interest**

Authors declare that there is no conflict of interests regarding the publication of this paper.

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