

**Original article:**

## **Stroboscopic Evaluation of vocal cord in Newly Diagnosed Hypothyroid Patients**

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### **Abstract**

**Introduction:** Videostroboscopy has become an important tool for evaluating the mucosal structure of vocal cord. The objective of this study was to document the stroboscopic findings of vocal cord in newly diagnosed hypothyroid patients.

**Materials and methods:** It was a cross sectional study conducted among newly diagnosed hypothyroid subjects visiting endocrinology OPD at Sri Ramachandra hospital, Chennai. In the absence of any data with respect to stroboscopic analysis of primary hypothyroid subjects it was decided to undertake a pilot study of fifty hypothyroid subjects with an equal number of age and sex matched euthyroid controls. Primary hypothyroidism was diagnosed on the basis of Serum TSH >10mIU / L and low free t4 (FT<sub>4</sub>). Visualisation of the larynx was done using a videostroboscope.

**Results:** Vocal cord edema (22%), erythema and oedema of inter arytenoid region, erythema of posterior supraglottis (14%) were the frequent structural changes seen in hypothyroid cases. The study showed a decrease in mucosal wave and amplitude, with asymmetry of vocal fold vibrations and incomplete closure of vocal cord in hypothyroid patients when compared to controls. It was also observed that the incidence of features suggestive of LPR (stroboscopic findings) was more in hypothyroid cases when compared to controls.

**Conclusion:** The present study helped us to see and record the various subtle changes in the vocal cord of newly diagnosed hypothyroid cases. It gave us an insight in understanding the dynamics involved in voice physiology.

**Key words :** Stroboscopy, Hypothyroidism, Vocal cord, Mucosal wave

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### **Introduction:**

Voice, a complex physiological function, is seen in its most sophisticated form among humans. Change in voice quality may be the harbinger of a variety of systemic disorders such as thyroid dysfunction. Hypothyroidism, the most common disorder of thyroid function is also the most common among all the endocrine disease in India with an estimated burden of 42 million in the post salt-iodization phase with the poor, mainly bearing the brunt of the disease <sup>2</sup>. Hypothyroidism is known to affect

phonation. Hoarseness of voice that is observed in hypothyroidism is usually overshadowed by a plethora of other complaints. Hoarseness of voice was observed in 34% patients as compared to 12.5% in controls in a study where the symptoms of hypothyroidism was analysed <sup>3</sup>. A recent Iranian study has stated that 81% of the hypothyroid subjects in their study had voice alteration<sup>4</sup>. Hypothyroidism being a common ailment, with hoarseness its frequent presentation, this study was

planned so as to assess the vocal chord changes through stroboscopic evaluation.

The vocal cords vibrate at over 100 cycles per second. Observation of such vibrations cannot be made with the unaided eye and requires special equipment. The human eye can resolve only five distinct images each second. So, vocal cord vibration can be observed only through high speed cinematography or through the application of stroboscopy.

Stroboscopy is the most practical technique available for visualization of the stable periodic vibration of normal, healthy vocal cords<sup>5</sup>. Videostroboscopy has contributed significant diagnostic information in 27.2% of the cases in a study on diagnostic value of stroboscopic examination in hoarse voice<sup>6</sup>. In the diagnosis and treatment of vocal cord pathologies, stroboscopy helps us understand the vibratory patterns of vocal cord during phonation.<sup>7</sup> With this background it was decided to evaluate and record the stroboscopic finding of vocal cord in newly diagnosed hypothyroid patients.

#### **Materials and methodology**

This cross-sectional study was conducted among fifty each newly diagnosed hypothyroid cases and euthyroid controls, visiting Sri Ramachandra hospital, Porur at Chennai over a period of 18 months (2009-2011) Study subjects included 43 females and 7 males in both cases and controls. (sex ratio of F:M being 6:1) Institutional Ethical Committee clearance was obtained prior to the onset of the study. Informed written consent was taken prior to the study of all subjects and controls. The hypothyroid subjects and controls were chosen according to the following inclusion and exclusion criteria. Inclusion criteria for hypothyroid cases were a) Newly diagnosed hypothyroid subjects in the age group (20 to 50 yrs) while the Exclusion criteria for hypothyroid cases

were a) History of Allergic rhinitis b) asthmatics, c) Oral, laryngeal & pharyngeal malignancy d) systemic illness e) acute respiratory illness. (during the procedure) f) smokers. Inclusion criteria for controls were healthy volunteers in the age group (20 to 50 yrs) and Exclusion criteria for controls were a) History of Allergic rhinitis b) asthmatics, c) Oral, laryngeal & pharyngeal malignancy d) systemic illness e) acute respiratory illness (during the procedure) f) smokers g) hypothyroid

#### **Data collection:**

A comprehensive history, using a questionnaire was taken and a detailed physical examination was carried out. Hypothyroid subjects signs and symptoms were assessed using the new Zulewski score.

Samples for FT<sub>4</sub> and TSH were collected from hypothyroid cases and blood samples from the controls were tested for TSH (using ultra sensitive sandwich chemiluminescent immunoassay) to exclude hypothyroidism.

Visualisation of the larynx was done using a videostroboscope. (ATMOS Medizin Technik GmbH Co). The procedure was explained by the Otorhinolaryngologist to the subjects. The subject was made to sit comfortably in the examination chair. A collar mike was attached to the neck of the subject to note the fundamental frequency. Lignocaine 5% was sprayed on the subject's throat. After holding the tongue, the scope was introduced trans-orally, and the subject was instructed to produce vocal sound as per the directions of the speech pathologist. Once the vocal cords were visualized the subject was asked to phonate /e/, glide /e/ from a low to high tone and the reverse, to cough gently and to take a deep inhalation. The entire recording took less than three minutes.

The recorded videos were reviewed jointly by the otolaryngologist and the speech pathologist. Glottal closure, regularity, symmetry of the vocal cord

vibration, mucosal wave and amplitude of vocal cord vibration and periodicity were the various headings under which results were reported. The laryngeal findings were noted as per the guidelines of the Sri Ramachandra University voice protocol.<sup>8</sup>

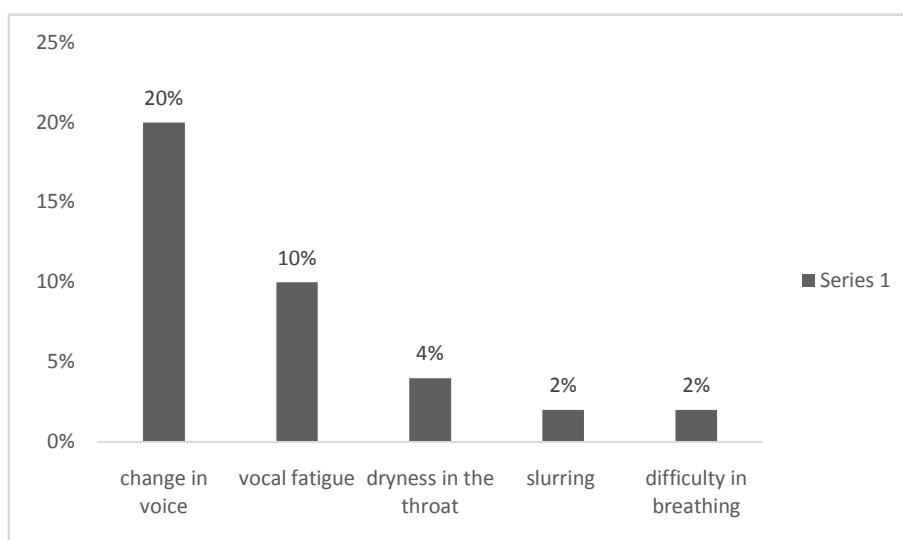
**Statistical analysis:**

In this initial cross sectional descriptive study the stroboscopic finding were analysed on a consensual basis by the otolaryngologist and the speech pathologist. Results were expressed in percentage.

**RESULTS:**

There were 50 hypothyroid cases - 43(86%)females and 7(14%)malesand the same percentage of euthyroid controls were chosen from volunteers. The mean age was 32.66 and 30.94 for cases and controls, respectively, with a range of 20-50 years. Mean TSH was 64.09 among cases contrasting with 2.12 among controls.

**Table 1** - Distribution of voice symptoms in hypothyroid cases :



The main complaints pertaining to voice in hypothyroid cases were change in voice including hoarseness (20%), vocal fatigue(10%), dryness in the throat(4%) ,and difficulty in breathing (2%)

**Table 2** Structural abnormalities of the vocal cord seen among cases and controls(In percentage)

Structural abnormalities	Cases	Controls
Vocal fold edema	22%	-----
Erythema / edema of posterior supraglottis, congestion of inter arytenoid	14%	4%
Left superior laryngeal nerve palsy	2%	-----
Posterior band hypertrophy	4%	-----
Over riding arytenoids	4%	-----
Bilateral vocal nodules	4%	-----
Sulcus vocalis	2%	-----
Irregular edge	2%	-----
MTD(muscle tension dysphonia)	2%	

Vocal fold edema (22%) was the most common structural finding noted among hypothyroid cases. The other common findings seen in hypothyroid cases were the erythema of posterior supra glottis /congestion and oedema of inter arytenoid (14%) and the same finding was seen only in 4% of

controls. Posterior band hypertrophy, over riding of aritenoids and bilateral vocal nodules were seen in 4% of cases respectively. 2% of hypothyroid cases had left superior laryngeal nerve palsy, sulcus vocalis and irregular edge of the vocal cord respectively.

**Table 3 OBSERVATION OF GLOTTIC CLOSURE DURING STROBOSCOPIC EXAMINATION**

S.No	Closure pattern	CASES	CONTROLS
1.	Posterior gap	34%	17%
2.	Longitudinal gap	18%	-----
3.	Irregular gap	10%	-----
4.	Bowing	4%	-----
5.	Double gap	2%	-----
6.	Complete closure	32%	83%

The different patterns of *glottis configuration* seen are presented in Table 3. Posterior gap was the most common finding followed by longitudinal gap and irregular closure.

**Table 4 Functional components of stroboscopic finding in cases and controls**

Stroboscopic finding	Cases	Controls
Mucosal wave	Reduced (46%)	Reduced (2%)
Periodicity	Aperiodic (16%)	Periodic (100%)
Amplitude (Rt and Lt)	Reduced (44%)	Normal (100%)
Symmetry	Asymmetry (40%)	Symmetry (100%)

The other stroboscopic findings are expressed in Table 4 :

*Mucosal wave* : Almost 46% of hypothyroid cases had reduced mucosal wave on both sides of the vocal cord while 4% had absent mucosal waves. This was in comparison to 98% of controls who had normal mucosal wave pattern. Aperiodic mucosal wave was observed in almost 16% of hypothyroid case. *Amplitude*: Amplitude of vibration was reduced in 44% of hypothyroid cases when compared to controls who had normal amplitude of vibration. *Symmetry* : Asymmetry was seen in 40% of hypothyroid cases.

It was observed that these structural and functional changes in vocal cord were more prominent in

patients who had voice complaints like change in voice, vocal fatigue and slurring.

**Discussion**

Thyroid has many physiological effects and is vital for the normal growth, development and for the maintenance of basal metabolic rate. Hypothyroidism is caused by the deficiency of thyroxine. Larynx is an end organ target for thyroid hormone<sup>9</sup>. Hypothyroidism can present itself as voice fatigue, dryness of throat with slow, hesitant speech or as hoarseness and in some patients as a change in voice. Vibrations of vocal fold are dependent on an intact superficial lamina propria, so any change in its histology or function causes

significant voice change. Hypothyroidism is known to cause the deposition of acid mucopolysaccharides in the sub epithelial laryngeal tissues.<sup>10</sup> There is a paucity of data on stroboscopic findings in hypothyroid subjects. This study was done to document the changes in the vocal fold in the newly diagnosed hypothyroid subjects by using stroboscopy.

Vocal fold edema was noticed in 22% of hypothyroid cases. The most characteristic clinical sign of hypothyroidism is generalized myxedema resulting from deposition of hydrophilic mucopolysaccharides particularly hyaluronic acid and chondroitin sulphate. The hygroscopic nature of hyaluronic acid allows the molecule to swell 1000 times its dry weight on hydration. The presence of Hyaluronic acid in the larynxes of rats with drug induced hypothyroidism was demonstrated as early as 1964 by Ritter et al<sup>11</sup>. So this deposition can be one of the causes for vocal fold edema seen in 14% of our hypothyroid patients. The other reason being discussed below.

The common laryngeal findings suggestive of LPR are arytenoid edema(80%) posterior commissure hypertrophy(77%) arytenoid erythema(76%) and pachydermia laryngitis(16%).<sup>12</sup> The important etiological factors associated with LPR are when the normal functioning of lower and upper oesophageal sphincter is affected or when the oesophageal peristalsis is compromised. Acid, pepsin, and bile acids are the harmful elements involved in the pathogenesis of LPR<sup>13</sup>. Pepsin is known to be important in causing mucosal damage and inflammation during non acidic reflux.<sup>14</sup> Esophageal motility disorders, with a decrease in lower sphincter pressure and associated gastric dysmotility are common features in hypothyroid subjects.<sup>15</sup> Muscle edema and changed myoelectrical activity has been attributed to the increased incidence of gastric dysmotility in

hypothyroid patients.<sup>16</sup> All these reasons may be responsible for the increased occurrence of findings suggestive of laryngopharyngeal reflux in our hypothyroid subjects(14%) when compared to controls(4%)

However, studies have proven that these signs of LPR are not very specific and can be found in other etiologies like smoking, allergy, infection or it can be a normal variant also. Hicks et al have noted that findings normally associated with LPR can also be found among 80% of healthy controls<sup>17</sup>. It has been proven that there is a wide variability in the reporting of laryngoscopic finding of reflux among examiners<sup>18</sup>. Only a study involving a larger sample size along with histopathological examination will enlighten us further to whether these changes are due to myxedematous edema seen in hypothyroidism or due to laryngopharyngeal reflux.

Complete glottic closure is essential for normal sound production. In this study almost 68% of the subjects had incomplete closure pattern. Posterior glottic opening was seen in 34% of hypothyroid subjects and 17% of our control. This can be a normal variant also for posterior glottis opening is seen more frequently in young women. Regular vibration of the vocal cord is essential for normal speech. Irregular vocal fold vibration was observed in 40% of our cases. A dynamic mucosal wave reflects the pliability of vocal fold covering and the efficient vocal cord vibration. In this study almost 44% of the hypothyroid had a significant reduced mucosal wave pattern while 2% of euthyroid showed reduced mucosal wave.

Amplitude of vibration was reduced in 44% of hypothyroid subjects when compared to euthyroid subjects in whom normal amplitude was observed. All these functional changes may be attributed to increased stiffness of vocal fold. And the reason for increased stiffness can be myxedematous edema

due to hypothyroidism or changes in vocal cord due to laryngopharyngeal reflux.

A comprehensive analysis of voice including acoustic voice analysis, auditory perceptual analysis and voice self analysis in these hypothyroid cases will further help in understanding more about the relationship of voice to thyroid hypofunction. Early changes being noticed and treated appropriately with speech therapy adjunct with medical line of management, will go a long way in helping the patients and improving their quality of life.

#### **Conclusion:**

The present study has shown us that Stroboscopy can be used as an important tool in understanding

the vocal cord motion biomechanics in hypothyroid cases and euthyroid controls.

#### **Further implications:**

This will pave the way for further studies in this arena and may help elucidate clinically significant patho-physiological relationships between hypothyroid and vocal cord and also observe the vocal cord changes after treatment.

#### **Limitations of the study:**

The limitation of this study was the smaller sample size. The cost, invasiveness, inter observer variability and limited availability of stroboscopy is a barrier to its consistent use in a large scale.

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