

# The Increase Level of Muscle Adductor in Idiopathic Vocal Cord Adductor Paralysis Post Biofeedback Vocal Therapy

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## Abstract

**Background:** The Idiopathic Vocal Cord Adductor Paralysis (KAKVI) is the inability of muscle that moves the vocalist notochord to medial in phonation time with the idiopathic. This condition might has impact to the emerge of hoarse voice and other lamentations which are related to the voice production. The conventional voice therapy still show the number of the recovery of low dysphonia.

**Method:** The diagnosis of KAKVI is based on the anamnesis, physical check up, thorax photograph and laryngoscopy fiberoptic and is conducted the measurement of vocalist cord adductor muscular construction strength before the BF voice therapy with equipments. Then, the BF voice therapy is conducted twice a week for four weeks. The voice exercise is continued in home once a day by patients themselves. The measurement of the strength of vocalist cord adductor muscle contraction is conducted after the BF voice therapy.

**Results:** The result of the study revealed that there were KAKVI. The result of adductor muscular contraction strength with statistic examination in a short test is  $p = 0,044$ . - The result of statistic examination of long a is  $p=0,000$ . - The result of statistic test of count test is  $p=0,000$ . Therefore, the change of adductor muscular contraction strength on KAKVI after the BF voice therapy is found a significant increase ( $p < 0,05$ ).

**Conclusion:** This study revealed that there are an increase of adductor muscular contraction strength in KAKVI after the BF voice therapy.

**Keywords:** *The strength of adductor muscle contraction, idiopathic vocalist cord adductor paralysis, voice therapy, Biofeedback.*

## Introduction

The paralysis of idiopathic vocalist cord adductor (KAKVI) is a muscular inability to move the vocal cord to medial on phonation time with an idiopathic cause which is the cause is undetected or the pat physiology. This condition can lead the emerge of hoarse voice and other lamentations related with the voice production<sup>1-5</sup>.

The KAKVI therapy consists of the nonsurgical therapy and surgical therapy. The nonsurgical therapy is the conventional voice therapy, then if it fails or there is particular indication, it can be taken into consideration with the surgical therapy<sup>1-3</sup>. At the Otolaryngology. Out-

patient Unit in Dr. Soetomo hospital, the conventional voice therapy on dysphonic still show low recovery number. This low recovery number might be caused by the low self-motivation of the patients to practice and control routinely<sup>4,5</sup>. The dysphonia research used other therapy methods which is expected to be more effective is the Biofeedback (BF) voice therapy. Biofeedback is the equipment to assist the patients to control voluntarily the strength of muscular contraction that is joined the vocal cord adduction process. However, the increase of adductor muscular contraction strength in KAKVI after the BF voice therapy is still unclear<sup>6-10</sup>.

The KAKVI patients at the Otolaryngology Out-patient Unit of Dr. Soetomo hospital is 176 (62,4%) of 282 patients (year 1995-1999) and 73 (54,07%) form 135 patients (year 2006-2010). The KAKVI therapy at Otolaryngology Out-patient Unit of Dr. Soetomo

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hospital is the conventional voice therapy, with the low recovery number of 19,6% and 25,56%<sup>4,5</sup>.

The BF voice therapy requires the electronic equipments which is the *laryngeal electromyography* (LEMG) through the electrode that is put in the surface, so it is called *surface laryngeal electromyography* (sLEMG) that shows the strength of larynx muscular contraction. The patients are asked to see the computer monitor to receive information about what happened in the their skins. The patients are asked to do the various kinds of practices under the voice therapist guidance while seeing the monitor (the feedback is visual signal) or listen to the beep voice (the feedback is auditory signal)<sup>7,11,12</sup>.

The BF voice therapy is started to be reported in the literature with a good result, that is the improvement of vocal cord deviation. According to the previous study, it was reported that 21 normal persons and 7 patients with vocal nodule who underwent the BF therapy session shows that there are a significant difference in EMG score, and the decrease level of muscle tension<sup>13</sup>. It revealed that there were positive correlation between the EMG result with the voice quality assessment.

Another study reported that the use of sLEMG thyroarytenoid muscle in 25 patient, is an efficient and objective test to provide the prediction of the recovery after facing a vocal cord paralysis. In this study, wants to prove the increase point of adductor muscle

contraction on KAKVI after the BF voice therapy.

### Material and Method

This study was conducted on June until August 2015 at the Otolaryngology Out-patient Unit and Medical Rehabilitation Instalation of Dr. Soetomo hospital, Surabaya. The study is about the change of the adductor muscle contraction strength in the idiopathic vocal cord adductor paralysis (KAKVI) after the BF voice therapy. The inclusion criteria of subject of study is KAKVI patients who diagnosed under the fiber optic laryngoscopy, attained the age of 20-60, understand the guidance and able to answer questions well, have the ability to control voluntarily, have self-movitation to coordinate well, willing to join the study, and sign the agreement letter in joining the study.

During the study period, it was obtained nine KAKVI patients who got the BF voice therapy twice a week in four weeks. The consecutive sampling is applied in this study<sup>14</sup>. The type of the study is pre experimental with the pre post design without control group. The measurement of adductor muscle contraction strength is conducted pre and post the BF voice therapy. In the BF voice therapy, the patients is asked to breathe in first, then say a long a in one breath, then do a count test in 1,2, 3, etc. in one breath with saying a loudly (short a) as long as the patients is capable.

### Results

**Table 1. Age Distribution**

| Age (year) | Quantity | %     |
|------------|----------|-------|
| 31-40      | 2        | 22,22 |
| 41-50      | 5        | 55,56 |
| 51-60      | 2        | 22,22 |
| Total      | 9        | 100   |

**Table 2. Gender Distribution**

| Gender | Quantity | %     |
|--------|----------|-------|
| Male   | 2        | 22,22 |
| Female | 7        | 77,78 |
| Total  | 9        | 100   |

**Table 3. Job Distribution**

| Job      | Quantity | %     |
|----------|----------|-------|
| Seller   | 4        | 44,45 |
| Sailor   | 1        | 11,11 |
| Operator | 2        | 22,22 |
| Teacher  | 2        | 22,22 |
| Total    | 9        | 100   |

The core data of the study included the ages, gender, jobs, and the clinic characteristic of the KAKVI patients who obtained the BF voice therapy. The most age group that was 41- 50 years was five-patients (55,56%). The youngest age was 31 years old, and the oldest one is 59 years old (table 1). The most gender is female which was seven patients (77,78%). The comparison between male and female is 1:3,5 (table 2). The most jobs is seller that are four patients (44,45%) (table 3). The vocal cord that were mostly encountered paresis is the right vocal cord that were five patients (55,55%) (table 4).

The measurement of the adductor muscle contraction strength in KAKVI pre and post the BF voice therapy. The strength of adductor muscle is measured by electromiograph which was completed by BF. The adductor muscle contraction strength is measured when the patients did the short a test, while the adductor muscle contraction endurance is measured when the patients did the long a test and count test. The strength of adductor muscle contraction when the patients did the short a test can be seen in table 5. The minimal average of the adductor muscle contraction strength is when the patients did the short a test before the BF voice therapy is 23,44  $\mu$ volt and post therapy is 17,66  $\mu$ volt. The maximal average of the contraction strength pre therapy is 43,44  $\mu$ volt and post therapy is 55,33  $\mu$ volt. The delta average or the gap between the maximal contraction strength and minimal contraction strength is 21,11  $\mu$ volt and post therapy is 37,66  $\mu$ volt. The statistic examination with the t pairing sample test is obtained  $p=0,044$ . It means that there is a meaningful difference between the minimal contraction strength and the maximal adductor muscle pre and post BF voice therapy ( $p<0,05$ ).

The endurance of adductor muscle contraction can be seen in the long a test and count test. The endurance

of adductor muscle contraction in a long a test is shown in table 6. The minimum average endurance of the adductor muscle contraction when the long a test is conducted based on seconds pre BF voice therapy is 6,22 seconds and post therapy is 18,55 seconds. The statistic examination with the t pairing sample is obtained  $p=0,000$ . It means that there is a meaningful difference between the minimal contraction endurance period and the maximal adductor muscle in the long a pre and post the BF voice therapy. The minimum average of the adductor muscle contraction endurance when the count test is conducted based on seconds the pre BF voice therapy is 7,33 seconds and post therapy is 23,77 seconds. The statistic examination with the t pairing sample examination is obtained  $p=0,000$ . It means that there is a meaningful difference between the minimal contraction endurance period and maximal adductor muscle in pre and post BF voice therapy count test ( $p<0,05$ ).

## Discussion

Many literatures stated that the vocal cord paralysis often encounter in the left side because the left vocal cord journey is much longer than the right side so it is easier to be affected by lesions. This condition is often caused by idiopathic, not because of inflammation, tumor, trauma, or neurological nuisance. This study revealed the number of KAKVI varied, 60% of the patients encountered the left vocal cord adductor paralysis and 40% of the patients encountered the right vocal cord adductor paralysis which cannot be known the causes<sup>15</sup>.

A meaningful difference or change is better between the pre and post BF therapy; it is because the high level of the patients' self-motivation in producing a sound when seeing the practice result in the monitor. The repeated practice or muscle re-education aims to obtain the

feedback that will control the neuromuscular; increase the muscle ability or muscle ability to tense, restore the agonist action/antagonist of normal muscle, and train the postural control. The patients used to produce a sound with the better muscle strength<sup>10,15,16</sup>.

In six patients with excessive laryngeal tension is conducted with giving 14 BF sessions in 30 minutes each session. At the end of every therapy, three of six patients encountered the reduction of laryngeal EMG level and their voice quality are getting better. Those mentioned improvement happened because the patients are suggested to see the contraction muscle in the monitor then the therapists facilitated the contraction with electric signal in the intended muscle so that the patients can practice well. The other two patients only encountered the change in the EMG level and there is no change in the voice quality. In these two patients, it is actually revealed that there are the heavy structure damage, so it is suggested that the BF therapy might be useful in the functional dysphonia patients only<sup>17</sup>.

To be normally voiced, not only the anatomy and cardiopulmonary are needed, but also the good physiological factor. In the KAKVI patients in this study, it is revealed that the adductor muscle that is unilateral, so that one of vocal cords cannot move to median and docked in a median line. The vocal cord paralysis is also affecting the vocal cord tension is lowered, so the vocal cord vibratio will also be disturbed<sup>18</sup>. The long a test is actually similar with the MPT test (maximum phonation time) that is often known in THT KL. *Maximum Phonation Time* is mostly related with the pulmonary condition while in this study, there is no deviation in lungs (idiopathic), so the long a test is mostly used to see the maximum vocal cord contraction<sup>16</sup>.

The other supported researches stated that 21 normal persons and seven patients with vocal nodule that undergo eight practice sessions with BF showed that there are a significant difference in LEMG score, and the reduction of muscle tension level. The reduction of muscle level happened because the chosen biofeedback for relaxation practice is high sensitivity setting, therefore that the small electricity activity is much easier to detect. When the relaxation is started to increase, the sensitivity setting is increased from low to high. This change caused the patients must relax more vocal cord muscles so that the relaxation is easier to reach. Moreover, there is a positive correlation between the LEMG result and the vocal quality assessment<sup>19</sup>.

In the long a test, the patients were asked to say a after breathing, until the they were out of breath, while there is a respite in count test when the patients said numbers until they were out of breath. The other researches that support showed that the use of LEMG in musculus tiroaritenoid in 25 vocal cord paralysis patients, use the efficient and objective equipment can predict about the recovery after suffering from vocal cord paralysis. This is said because the biofeedback practice can increase the comprehension of how the effort in producing sound and patients can handle the vocal cord muscle relaxation response. In the initial session with biofeedback, the patients can centralize their attention to the feedback and try to handle the sound or visual. When the patients paid attention to the relaxation, they will be able and succeed to handle the sound better<sup>20</sup>. Other suitable researches conducted the BF combination with other types of BF with targeting not only in tension and larynx muscle but also the relaxation in general. The use of BF in other voice deviation is rarely obtained, such as ventricular fold dysphonia and paradoxical vocal fold motion, is reported to give the good result<sup>6</sup>.

The result of BF measurement can be observed, amplified, and transformed, so that it can give feedback about the condition of patients body in a form of visual signal, particularly in graphic and beep voice that can be understood. The signal is applied to be the guidance to manipulate the signal that appeared in the BF equipment. The patients can learn to control to handle their condition, and make changes, such as relaxation or strengthen the particular tonus muscle. *T h i s* technique requires the patient's willingness to conduct the signal change in order to reach their aims. The BF therapy is defined as particular therapy technique that gives the patients strengths to use their mind to control their body and practice to improve their health by using the signal form their own bodies. The mentioned improvement can be reached if the patients see the contraction muscle in a monitor, then the therapist facilitated contraction with electrical signal in the intended muscle, so that the patients can practice to tense the muscle well<sup>7,9-12,21</sup>.

## Conclusion

It can be concluded that there is an increase in adductor muscle contraction strength in the idiopathic vocal cord adductor paralysis (KAKVI) post biofeedback voice therapy.

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**Ethical of Clearence:** This study was approved by Ethical Commision of Health Research Faculty of Medicine University of Airlangga

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