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EMG biofeedback in the treatment of hyperfunctional voice disorders

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The University of Montana

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EMG BIOFEEDBACK IN THE TREATMENT
OF HYPERFUNCTIONAL VOICE DISORDERS

by

Angela Bosma

B.A. Michigan State University 1986

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Date
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Tension in Hyperfunctional Voice Disorders

A hyperfunctional voice disorder is thought to be caused by the misuse or abuse of the vocal mechanism. Murphy (1964) stated that the faulty use of a healthy organ or system could lead to a functional voice disorder. Boone (1982) described hyperfunctional voice disorders as disorders which were "related to faulty use of the larynx" of which a "common problem is vocal abuse, which involves using the laryngeal mechanism excessively". Koufman and Etzold (1980) in their study on classification and approach to patients with voice disorders described those clients with a functional voice disorder as having "demonstrated patterns of vocal abuse". The abusive behaviors frequently mentioned include throat clearing as well as shouting and hard glottal phonation (Boone, 1971; Palow and Kaplan, 1979; Van Riper and Emerick, 1984 and Greene, 1980). Although these authors provided their own description of hyperfunctional voice disorders, a common characteristic of the disorders was excessive tension.
Excessive tension negatively affects the laryngeal mechanism. As Punt (1979) stated, muscle groups work together so that if one group of muscles is contracted, other muscles within the same physical region will contract as well. Excessive tension exhibited in any muscles in the laryngeal area will then cause tension in internal muscles of the larynx as well. If a subject exhibits excessive tension in the neck and upper chest, then it can be assumed that tension is also present in the internal muscles of the larynx. This excessive laryngeal tension can generally be observed in behaviors which are considered to be abusive to the vocal mechanism. Some common behaviors frequently listed as being abusive are excessive coughing and throat clearing, screaming, shouting, and talking in noisy environments (Boone, 1971; Falow and Kaplan, 1979).

Breathing patterns have also been implicated as an etiological factor for hyperfunctional voice disorders (Brodnitz, 1953). Clavicular breathing, an improper method of breathing which involves using the neck accessory muscles for inhalation (Boone 1982), utilizes excessive tension which does not aid in breathing. Excessive muscle tension is necessary to bring air into the lungs and to force words out. This tension, often visualized in the sternocleidomastoid muscle, extends into muscles in the laryngeal area (Greene, 1980). Van Riper and Emerick (1984)
stated prolonged loud talking in combination with improper breathing and body tension can lead to the structural damage of the vocal cords.

Psychological tension or stress is also reported as being a factor in hyperfunctional voice disorders. This anxiety or stress often leads to increased physical tension which will then, in turn, affect the vocal mechanism.

Greene (1930) discussed this relationship when she stated that the physical tension frequently seen in hyperfunctional voice disorders is a "reflection of the mental state of the individual, of his general anxiety and nervousness". Punt (1979) made a similar statement regarding the effects of stress on the laryngeal mechanism. He stated the vocal mechanism may be "adversely affected by the state of mind and the emotions of the owner of the voice". Luchsinger and Godfrey (1965) described a specific personality type as being susceptible to functional voice disorders. They suggested that people with "aggressive, outgoing personalities whose voices reflect inner strength and loudmannered natures" are those individuals who are prone to hyperfunctional voice disorders. Murphy (1964) summed up the relationship between stress and tension when he stated "the body does not relax if the mind is explosive".

Excessive tension is not the single cause of hyperfunctional voice disorders. It is seen as just one
factor from a variety of abusive behaviours contributing to these disorders. Several authors have written about specific characteristics frequently seen together along with excessive laryngeal tension. The "Bogart - Bacall Syndrome" as described by Koufman and Blalock (1988) described characteristics noted together. They described a hyperfunctional voice disorder as a "musculoskeletal tension disorder involving the larynx and supporting structures", thereby implicating excessive tension as a cause, and then went on to describe characteristics. They listed muscle tension in the neck, poor control of the breath stream, and an abnormally low-pitched speaking voice. Morrison, Ramage, Belisle, Fullan, and Nichol (1983) described a hyperfunctional voice disorder which they called "muscular tension dysphonia". They listed improper posture and tight muscle groups as characteristics of the disorder.

When a person continues to use patterns of abusive behaviours or frequently speak while the vocal cords are inflamed and irritated due to the presence of a cold or the flu, the abusive patterns often become habitual. This habitual pattern of voice production frequently leads to a hyperfunctional voice disorder (Siez, 1987). These habits are difficult to change as documented by Luchsinger and Godfrey (1965) who state, "vocal overexertion is of involuntary nature in the sense that it is not consciously
intended". They also stated "for various reasons, increased vocal efforts are made when speaking until these excessive patterns become a habit from which the afflicted patient can no longer break loose".

Excessive muscle tension is then seen as a major contributing factor in hyperfunctional voice disorders and modifying this tension is considered to be imperative to progress in therapy. It is, therefore, important to address both physical tension and stress, as seen in abusive behaviors, immediately upon initiation of voice therapy. As reported by Sies (1987), "relaxed phonation is absolutely necessary in order to obtain satisfactory voice quality and remove laryngeal irritation". Greene (1980) stated that although muscles are never in a state of complete relaxation, the aim is for controlled relaxation of muscles which are not necessary to maintain proper posture. Van Riper and Emerick (1984) stated that tension in any area of the body tends to flow upward and focus in the larynx.

Treatment Methods

Excessive tension is often difficult to alleviate. Murphy (1964) stated that although a relaxed state of vocal functioning is an important therapy goal, it is difficult to tell a person to relax when he is not relaxed. Boone (1980)
indicated that it is futile to inform a tense client to relax. If the client were able to relax, he would do so. Murphy (1964) described relaxation as a change in the client's mental state which resulted in feelings and attitudes of well-being. Upon completion of the changes in feelings and the development of a positive attitude, the client should achieve relaxation secondary to the changes.

Treatment of tension in hyperfunctional voice disorders frequently utilizes techniques which provide the client with subjective feedback alone. An example of this type of technique is the chewing method which utilizes the act of chewing in a specific manner. Tension is felt when the teeth are pressed together. This technique is most often used by the client after it with direct supervision. However, they also stated many clients experienced difficulties utilizing the chewing method as they tended to exaggerate the necessary movements which, therefore led to increased tension. This technique has also been described as being difficult to transfer out of the therapy setting.

Progressive relaxation, deep relaxation, or generalized relaxation techniques have been more commonly used in the treatment of hyperfunctional voice disorders (Milner and Salatoff, 1987; and Koufman and Blalock, 1988). When using this technique, the client becomes aware of tension by first being able to discriminate between tension and relaxation.
As the client becomes aware of tension and how to improve overall relaxation, he should then transfer that ability to relax in different situations.

Although progressive relaxation exercises may not be successful when used alone, they do provide the client with some awareness of relaxation. Several studies have addressed the effectiveness of general relaxation techniques. Strandberg, Griffith, and Hollowell (1971) used deep muscle relaxation in a case study of a woman with "psychogenic hoarseness" who exhibited excessive tension. Progressive deep relaxation combined with gradual shaping of normal phonation was successful in reducing tension and improving voice quality. Koufman and Blalock (1988) found progressive relaxation techniques to be successful in alleviating the musculoskeletal tension associated with the "Bogart-Bacall Syndrome". Perkins (1983) described a method by Diane Bless which included relaxation as a part of therapy but focused mainly on overall life relaxation. She required clients to participate in physical activities which would aid in reduction of overall stress and tension such as jogging, racquetball, or aerobics.

Biofeedback has also been used in conjunction with progressive relaxation techniques in the treatment of excessive laryngeal tension as exhibited in functional voice disorders. Studies have been completed which addressed the
use of biofeedback as a therapy technique used to reduce excessive tension as related to hyperfunctional voice disorders. Prosek, Montgomery, Walden, and Schwartz, (1978) completed a study using EMG biofeedback with hyperfunctional voice clients. They concluded that biofeedback would be most successful with patients who exhibited excessive tension as biofeedback provided an "accurate external monitor of laryngeal tension" which allowed the client to concentrate on developing methods to reduce tension. Stilson, Matus and Ball (1980) also stated that biofeedback was useful as it provided awareness of muscle tension which was necessary for relaxation. Budzynski and Stoyka (1989) stated that they found analog feedback (auditory) to be more successful than progressive relaxation when attempting to achieve deep muscle relaxation. Andrews, Warner, and Stewart (1986) completed a study using biofeedback and relaxation as treatment methods and found results which indicated there were improvements noted for both methods, however, neither one of the methods was proven to be more effective.

Although biofeedback has been shown to be effective in reducing tension, several problems may also arise. Prosek and colleagues (1978) stated that biofeedback is not successful with every subject who exhibits tension. They specifically found it to be most successful with subjects...
who did not exhibit any permanent laryngeal damage.

Difficulty often arises in the maintenance phase of therapy. The Cyborg J53 EMG Biofeedback Instrument stated, "as training progresses, the patient's own proprioception begins to take over from the instrument". However, transfer and maintenance of the abilities learned while using biofeedback may prove to be difficult in that the subject may begin to rely on the auditory or visual feedback in order to achieve relaxation. Davis and Dricha (1980) discussed the use of biofeedback with hyperfunctional voice clients. They reported it was useful in reducing vocal intensity which reduced vocal nodules, however, after five months of therapy, carry-over into spontaneous conversation had not occurred.

Voice therapy at Foothills Hospital in Calgary, Alberta, used progressive relaxation techniques alone in order to facilitate relaxation. However, studies, such as those cited above, have been completed which indicate that biofeedback is an effective method to aid in relaxation although the ability of clients to maintain the learned behaviour has been questioned. Due to the proven effectiveness of biofeedback to induce a relaxed state, and the desire for an alternative means to facilitate relaxation, biofeedback was chosen as an alternative method to aid in relaxation with voice clients being seen at

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Foothills Hospital during Winter 88. As progressive relaxation was the primary means of relaxation, that method was chosen to be used in conjunction with biofeedback. The results of the therapy using biofeedback and progressive relaxation in conjunction were to be compared with results of therapy which consisted of progressive relaxation alone to determine if relaxation could be achieved with more success in hyperfunctional voice clients.

PROBLEM

Treatment of hyperfunctional voice disorders at Foothills Hospital has traditionally used a plan of treatment which consisted of a comprehensive vocal hygiene program, elimination of abusive behaviours, mask phonation, relaxation exercises and a modified vocal rest program. The progressive relaxation technique was used by all subjects. Although it was an effective method of relaxation, both the clinician and the client experienced difficulties with this technique. The client often experienced difficulty maintaining relaxation upon completion of the exercises, and the initiation of further therapy tasks compounded the problem. In addition, the client often became frustrated if tension increased when relaxation exercises were completed. Several clients reported they were relaxed although excessive external neck tension would remain visible to the
The clinician's feedback about the client's state of relaxation was subjective (e.g. "you look tense today" or "you look more relaxed"). Although this type of feedback was helpful, the client often needed more feedback in order to make changes in the degree of tension. The clinician had difficulty measuring and recording each individual subject's level of tension from session to session. This made it difficult for the clinician to provide feedback regarding overall tension and any possible reduction of tension from the previous sessions.

An alternative technique to facilitate and objectively measure relaxation was desired due to the difficulties described above. The method chosen to facilitate relaxation was EMC biofeedback. EMC biofeedback would provide clients with a baseline measure of tension during the evaluation. The client could then chart his progress each session by comparing his threshold of relaxation to the baseline measure. Auditory and visual signals from the equipment provided immediate feedback regarding the degree of tension or relaxation. The clinician could also provide objective, consistent feedback (e.g. "baseline was 40, the level today is 20") both during each session and from session to session.
CHAPTER II

METHOD

Subjects

Eight adult subjects (7 females and 1 male) participated in the study. Each subject was diagnosed with functional voice disorders by an otolaryngologist and a certified Speech-Language Pathologist (ASHA and CASLPA) and were hospital outpatients from Foothills Hospital in Calgary, Alberta, Canada. All subjects exhibited a hoarse voice quality ranging from slightly hoarse to moderately hoarse, speech on residual air, as well as some form of tension. This tension was exhibited as excessive mandibular tension, excessive neck tension or excessive contraction of neck muscles or reported upper chest tension. Table one presents the composite vocal cord characteristics of the subjects in this study. Six of the subjects exhibited the abusive behaviours of excessive coughing and throat clearing. Five of the subjects exhibited a subjectively judged low habitual pitch and excessive phrase lengths. Three of the subjects exhibited shallow jerky breathing and hard glottal phonation. Two exhibited a rapid rate of speech while one exhibited a slight spastic voice quality.
<table>
<thead>
<tr>
<th>Subject</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoarse Voice Quality</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Speech on Residual Air</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Excessive Tension</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Coughing/Throat Clearing</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Low Habitual Pitch</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Excessive Phrase Lengths</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Shallow Jerky Breathing</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard Glottal Phonation</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Rapid Rate of Speech</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subjects were randomly divided into two groups: a treatment group and a control group. Each group consisted of four clients; however, only seven subjects completed the study. One subject in the control group did not complete the study as he frequently cancelled therapy sessions and reported family problems which kept him from participating in therapy.
**Procedure**

Upon arrival at the Foothills Hospital Speech Pathology Department, the subjects were given a consent form to read and sign (see Appendix A). A baseline measure of external neck tension was obtained for each subject using a J53 Cyborg EMG biofeedback instrument prior to initiation of the assessment. Electrodes were placed using external placement in the laryngeal area. During all biofeedback measures, clients were seated in a relaxed position (e.g., arms resting at side, feet flat on the floor). During the initial assessment, measures were taken immediately without allowing the clients time to concentrate on relaxing. Subjects then completed case history questions regarding their medical history, therapy history and family history. They also described their vocal use, the cause and length of the problem, as well as the variation and severity of the problem. An assessment of the present status of the client's voice functioning was completed (see appendix B). The clinician provided clients with feedback regarding their voices and presented them with a plan of treatment based on the initial problem list. Subjects asked any questions they may have had regarding the assessment. Therapy sessions were scheduled two to three times each week for a five week period. All subjects' plan of treatment included...
a comprehensive vocal hygiene program (see appendix C), elimination/reduction of abusive behaviours through the use of charting (see appendix D), mask phonation, relaxation exercises (see appendix E), and a modified vocal rest program (see appendix F) for future reference. The control group used the progressive relaxation exercises alone, while the treatment group used the same progressive relaxation techniques in conjunction with EMG biofeedback. Measures of external neck tension were taken during each session for the treatment group. Clients were given approximately ten minutes at the initiation of each therapy session to concentrate on relaxation before measurements were taken. Upon completion of relaxation tasks, therapy focused on the goals stated in the plan of treatment. Although the same procedures were used, due to the variability among clients, different aspects were focused on in greater detail for each client. Upon completion of the therapy period, a post-treatment measure of external neck tension was obtained from both the control group and the treatment group.

Instrumentation

The biofeedback unit utilized for the study was obtained from the Foothills Hospital Physiotherapy Department. The instrument used was J53 Cyborg unit with
internal calibration. It was used as a single channel EMG which provided the subjects with direct feedback regarding a specific muscle group. They were provided with both auditory and visual feedback from the biofeedback machine. "Quick Stick Sensor" surface electrodes were used and were placed over the larynx to obtain threshold measures in microvolts. Three electrodes were used with the ground electrode placed in the center. Laryngeal placement was chosen to obtain a measure of tension in the neck and laryngeal area.

Data Analysis

The results of the two treatment methods were compared and were to be statistically analyzed using an analysis of variance (ANOVA) to determine the difference between the two groups. An in depth statistical analysis using ANOVA was not completed due to the uneven number of subjects in each group completing the study and the unequal number of therapy sessions attended by each subject thus resulting in differences between the two groups. Although an indepth statistical analysis was not completed, descriptive observations were made regarding the results obtained.
CHAPTER III

RESULTS

The purpose of this study was to determine if the use of an objective measure such as EMC biofeedback used in conjunction with progressive relaxation was a more efficient method of relieving excessive tension in the laryngeal area than progressive relaxation techniques used alone.

The statistical analysis chosen to determine if significant differences were achieved was an analysis of variance (ANOVA). However, due to the difficulties encountered controlling the variables of numbers of clients and numbers of sessions during the study, the data obtained were not adequate enough to perform this statistical analysis. The number of subjects who completed the study was different for each group; three in the control group and four in the treatment group. The number of sessions attended differed among subjects in both groups. Although equal numbers of clients in each group were scheduled for two to three sessions each week, all clients missed at least one of the scheduled sessions (see Table 2). Attendance varied from two to nine sessions attended. Due to the five
week time period for the study, scheduling of alternative sessions was not possible.

Table 2. Subject (Control and Treatment) Attendance in Therapy

<table>
<thead>
<tr>
<th>Subject- Control (1-4) and Treatment (5-8)</th>
</tr>
</thead>
<tbody>
<tr>
<td># of sessions</td>
</tr>
<tr>
<td>attended</td>
</tr>
<tr>
<td>1  2  3  4  5  6  7  8</td>
</tr>
<tr>
<td>8  9  5  2  6  5  5  4</td>
</tr>
</tbody>
</table>

Although a statistical analysis was not completed, observations were made regarding the acquired data. Tables 3 and 4 show individual threshold measures for all clients. Table 3 shows the data obtained from the treatment group during each session attended. Table 1 shows the pretherapy and posttherapy measures obtained from the control group. Measurements are on microvolts with low scale indicating low degree of tension and high numbers indicating higher tension.
### Table 3. Threshold Measures (microvolts) for Treatment Group Using J53 Biofeedback

**Session Measures**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Measure 1</th>
<th>Measure 2</th>
<th>Measure 3</th>
<th>Measure 4</th>
<th>Measure 5</th>
<th>Measure 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5.0</td>
<td>4.0</td>
<td>4.5</td>
<td>7.5</td>
<td>3.5</td>
<td>2.5</td>
</tr>
<tr>
<td>6</td>
<td>5.0</td>
<td>7.5</td>
<td>5.0</td>
<td>4.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>5.0</td>
<td>6.5</td>
<td>4.5</td>
<td>3.5</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>5.0</td>
<td>4.5</td>
<td>4.0</td>
<td>5.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 4. Threshold Measures (microvolts) for Control Group Using J53 Biofeedback

<table>
<thead>
<tr>
<th>Pretherapy Measure</th>
<th>Posttherapy Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject 1</td>
<td>5.0</td>
</tr>
<tr>
<td>2</td>
<td>4.0</td>
</tr>
<tr>
<td>3</td>
<td>4.0</td>
</tr>
<tr>
<td>4</td>
<td>5.0</td>
</tr>
</tbody>
</table>

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Table 5 - Mean Scores of Measures (microvolts) of Excessive Laryngeal Tension Obtained Using J53 Biofeedback for Pretherapy and Posttherapy Measures

<table>
<thead>
<tr>
<th>Control Group</th>
<th>Pretherapy Measures</th>
<th>Posttherapy Measures</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=3</td>
<td>4.3</td>
<td>2.3</td>
<td>2.0 (47%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Pretherapy Measures</th>
<th>Posttherapy Measures</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=4</td>
<td>5.0</td>
<td>3.2</td>
<td>1.8 (36%)</td>
</tr>
</tbody>
</table>

As is shown in tables 3, 4 and 5, reduction of tension was achieved in both groups, except for subject 3, during the therapy period. There was not, however, a greater decrease in tension in the group which used EMC biofeedback in conjunction with progressive relaxation exercises as compared to the group using progressive relaxation alone. As indicated, both groups exhibited a decrease in tension during therapy. Most subjects also exhibited some improvement in voice quality and a reduction of abusive behaviours during the therapy period. It was noted that all subjects but one exhibited improvement but a greater change
was noted in subjects who attended therapy on a more regular basis.

These results do not show biofeedback used in conjunction with progressive relaxation exercises to be more effective in achieving relaxation than progressive relaxation techniques alone.

Summary

Statistical analysis of the results was not completed due to the discrepancies between the number of subjects in each group and the discrepancy between the number of sessions each subject attended. Observation of the data showed that both groups achieved some reduction of tension during the therapy period. However, the data obtained do not indicate that the use of biofeedback in conjunction with progressive relaxation was more successful in reducing excessive laryngeal tension than progressive relaxation used alone. Results of therapy also show that improvement was noted in subjects in both groups indicating that the use of biofeedback does not result in greater improvement in voice quality nor more rapid progress in therapy. Further research involving a group using biofeedback alone would be necessary to make conclusions on the benefits of biofeedback both for the reduction of tension and the improvement of voice quality.
It is necessary to consider the variables of subject attendance and length of therapy periods. Difficulty was experienced while trying to control these variables and therefore, reliable statements regarding the effectiveness of either type of therapy could not be made. Equal numbers of sessions during the same time period were necessary to ensure each client received the same amount of instruction.

The individual subject characteristics such as length of problem, severity of problem and previous therapy results must also be addressed while controlling variables. Subjects exhibiting mild hoarseness and minimal tension may progress with much more success using either technique than clients with severe hoarseness and excessive tension. These areas must be more fully addressed before any reliable or valid statement can be made regarding the effectiveness of biofeedback techniques used alone or in conjunction with progressive relaxation techniques.
The purpose of this study was to determine if objective feedback provided by EMG biofeedback coupled with progressive relaxation would be a more effective means of achieving relaxation in clients with functional voice disorders than using progressive relaxation techniques alone. Due to the inconsistent subject attendance in therapy and the failure of one subject to complete the study, results were not sufficient to complete a comprehensive statistical analysis. However, several observations may be made as a result of this study.

The first observation made was regarding the apparent effectiveness of EMG biofeedback as a therapy tool used in conjunction with progressive relaxation exercises. Although subjects in the treatment group did not achieve a statistically significant greater reduction of tension than the control group some benefits of biofeedback were noted. Subjects in the treatment group indicated they found the auditory and visual feedback provided by EMG biofeedback to help them become more aware of the tension they exhibited.
They could then be more successful monitoring and modifying that tension.

The second observation made was regarding the differences among subject attendance in therapy. Many clients frequently cancelled therapy sessions or did not show up for scheduled appointments. Although the importance of therapy was stressed, clients reported other commitments as being more important which prohibited them from attending voice therapy. This lack of attendance may in part be due to lack of commitment on their part and the low priority they placed on voice therapy. As a hyperfunctional voice disorder posed no threat to the subject's health, it was generally not considered to be important. Another factor affecting attendance may have been the acceptance of hyperfunctional voice disorders in society. One subject reported she did not feel people were negatively affected by her hoarse voice quality as they frequently thought she had a cold.

A third observation made was regarding the diversity among the subjects. All subjects exhibited some degree of hoarseness and tension, but not all subjects exhibited hard glottal phonation or a low habitual pitch. Although clients were randomly divided into two groups, the individual differences may have affected their success in therapy. If a subject only exhibited mild hoarseness, he may have been
successful had he used progressive relaxation techniques alone or had he used progressive relaxation in conjunction with biofeedback techniques due to the mildness of the disorder. If a client exhibited only a few characteristics, prognosis for improvement may have been better due to the relative mildness of the disorder.

Suggestions for Further Research

The results of this study did not show biofeedback and progressive relaxation techniques used together are more successful in helping clients achieve relaxation than progressive relaxation alone. However, before reliable and valid statements regarding the effectiveness of biofeedback can be made, further research is necessary.

As was shown in Table 5, biofeedback was not more successful than progressive relaxation techniques used alone nor did it result in a greater improvement in relaxation. A larger sample size with equal numbers of subjects in each group, a uniform therapy period and equal numbers of therapy sessions would be necessary before a complete statistical analysis could be conducted to prove the effectiveness of biofeedback. A group using biofeedback alone to increase relaxation would indicate if biofeedback was successful for this type of client.
It would also be important to address the aspect of individual subject characteristics. Subject characteristics should be shared with the subjects placed on biofeedback electrodes. In the study, we should focus on the severity of the voice problem as exemplified by the individual voice characteristics, not only on the basis of the broad diagnosis of a functional voice disorder.

In order to more fully address which type of therapy is most beneficial, therapy could consist of biofeedback alone and progressive relaxation alone. These could be used in conjunction with other procedures such as yawn-sigh method or chewing method or they could be used as the only therapy procedures to truly assess their benefit in hyperfunctional voice disorders.

Although not addressed in this study due to the limited time period utilized, the issue of maintenance of learned relaxation techniques should be addressed. A study addressing the maintenance of learned techniques for the different groups of subjects would be beneficial and would aid in the choosing of therapy procedures.

During this study biofeedback electrodes were placed on the neck in the laryngeal area and measurements were taken after ten minutes of relaxation. Further research could address the question of using electrode placement on the frontalis muscle, which would give an indication of overall...
tension, as opposed to a specific muscle group tension level. Further studies could address the aspect of when measurements are taken such as after relaxation or during speech.

**Summary**

Results of this study did not show that biofeedback helped in the reduction of excessive laryngeal tension as exhibited by clients with functional voice disorders with greater success than progressive relaxation techniques used alone. Biofeedback did not result in greater relaxation. Further research controlling more variables would be necessary to determine if biofeedback would be a beneficial therapy tool in the treatment of functional voice disorders.
APPENDIX A

CONSENT FORM

I am conducting a study in which I am comparing results of different treatment procedures which are currently being used with voice clients. In order to complete this study, I would like to use therapy data from clients who are being seen by a Speech Pathologist in Foothills Hospital for treatment of voice disorders.

Please sign this consent form if you agree to let the results of your therapy be used in this study. The information obtained will be used for research and educational purposes and will not include any personal identification.

Name: __________________________________________
Date: __________________________________________

Angela Bosma, B.A.
Speech Pathology Graduate Student
University of Montana
APPENDIX B

Voice Assessment Form

Name: 
D.O.B.: 
Date of Assessment: 

Diagnosis: 
Physician: 

MEDICAL HISTORY
Do you have allergies or sinus problems?
Have you had tonsil or adenoid problems?
Have you had any thyroid or metabolic imbalances?
Are you exposed to airborne irritants (pollution, dust)?
Have you had any surgery related to your voice problem?
Have you had any accidents or trauma to the neck or throat?
Do you smoke/use drugs/drink?
Do you have a hearing problem?
Are you taking any medication?
Do you feel any pain or discomfort in your neck or throat?
Do you feel tension in your neck or throat?
Does anyone else in your family have a voice or hearing problem?

Do you use a humidifier at home/work?

VOCAL USE
Do you find you use your voice differently in various situations? (socializing, work, home)
Do you sing extensively?
What do you do for a job?
How do you feel this affects your voice?

DESCRIPTION OF THE PROBLEM
Describe your voice problem.
Describe the onset of the problem (gradual/sudden).
Who discovered the problem?
What do you feel is the cause?
Describe how your voice has changed since the onset.
When is your voice at its best/worst?
What are you most concerned about?

THERAPY HISTORY
Have you had previous therapy or assessments?
What were the results?

VOCAL QUALITY

<table>
<thead>
<tr>
<th>quality</th>
<th>acceptable</th>
<th>resonance</th>
<th>acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>strident</td>
<td></td>
<td>hypernasal</td>
<td></td>
</tr>
<tr>
<td>breathy</td>
<td></td>
<td>hypernasal</td>
<td></td>
</tr>
<tr>
<td>hoarse</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>harsh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glottal fry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>aphonic breaks</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
BREATH SUPPORT

respiration - clavicular shallow
thoracic deep and audible
abdominal deep and inaudible

audible inhalation shortness of breath
inhalatory stridor breathes before speaking

posture

tension - facial external laryngeal
mandibular upper chest

DURATION OF PHONATION

client shouts client whispers
conversational volume
laryngeal efficiency - s/z ratio

s-
z-
ratio-
maximum phonation time /a/

quality rate (norm in words/minute - 150-180 reading, 140-160 speaking)

BEHAVIOURAL OBSERVATIONS
coughing throat clearing hard glottal phonation
diplophonia pitch breaks phonation breaks
vocal tremour reverse phonation strained
vocalizations
mouth breathing speech on residual air
diodoachokinetic rate - norm 20/4 - 7 seconds

/p/ /t/ /k/

SUPRASEGMENTAL FEATURES

pitch - acceptable high low falsetto
objective measure used - optimal habitual high
loudness - acceptable loud soft
vocal range/intonation - acceptable monotone
stress - appropriate inappropriate
phrasing - acceptable inappropriate
rate - acceptable slow fast
duration of pauses
duration of syllables
duration of phrases

PROBLEM LIST

RECOMMENDATIONS

GOALS

PROCEDURES

(Adapted from McDonough, 1987)
APPENDIX C

VOCAL HYGIENE PROGRAM

1. Identify vocal abuse and misuse (shouting, throat clearing, laughing, etc).
2. Reduce or eliminate the identified abuse and misuse.
3. Develop an easy glottal attack.
4. Use a speaking level that is where you should be. Avoid singing at extreme voice levels.
5. Keep your speaking voice at the lower end of your loudness range.
6. Take an easy, relaxed breath when speaking.
7. Reduce vocal demand as much as possible. Speak or sing less.
8. While listening, keep your teeth separated with a slight lip opening.
9. Avoid talking in loud settings (disco, airplanes, cars, boats, etc).
10. Avoid smoking and excessive use of alcohol.
11. Avoid odd sounds with your voice, such as imitating engines, funny voices etc.
12. Keep the membranes of your mouth and throat as moist as possible.

(Boone, 1983)
APPENDIX D

Vocal Abuse List

1. Don't abuse your voice.
   - don't clear your throat or cough habitually
   - don't yell, cheer of scream
   - don't talk over a long distance, especially outside
   - avoid talking in a noisy environment; over loud music, at noisy parties, over heavy machinery
   - don't try to lecture or speak to large audiences without the aid of a microphone
   - don't try to teach or instruct above musical instruments, singing, students talking
   - don't sing beyond comfortable pitch and loudness range
   - avoid nervous abusive habits during lecturing, public speaking, debating such as throat clearing, holding your breath, talking quickly, talking on insufficient breath, using a monotone pitch or use of aggressive or low-pitched fillers (uh, um)
   - avoid prolonged loud and vocally aggressive laughing or crying
   - don't yell or speak extensively during strenuous exercise

2. Don't misuse your voice
   - don't speak on a low, monotone pitch and don't allow your vocal energy to drop so low that the sound becomes gravelly (glottal fry)
   - don't hold your breath as you're planning what to say or how to say it - avoid initiating voice with a harsh and sudden glottal attack
   - don't speak beyond a natural breath cycle; avoid squeezing the last few words out
   - don't tense your upper chest, shoulders, neck and throat to breathe in or to push out
   - if you sing, don't force your voice to stay in a register beyond it's comfortable pitch range
   - never clench your teeth, don't hold your jaw tense, and don't move your jaw stiffly to speak
   - avoid making unconventional sounds with your voice for prolonged periods; don't whisper

3. Maintain a healthy lifestyle and healthy environment
   - don't demand more of your voice than you would the rest of your body
   - don't use your voice extensively when you have a cold or when you feel tired
don't use your voice when it feels strained
don't ignore prolonged symptoms of vocal strain, hoarseness, pain, fullness, heartburn or allergies
don't expose your voice to excessive pollution; cigarette smoke, chemical fumes, etc.

(Rammage, 1986)
APPENDIX E

Progressive Relaxation

Begin by sitting in a comfortable chair.

Clench your fists tighter and tighter. Study the tension in your hand and forearm. Be sure to keep the rest of your body relaxed. Loosen the fingers. Feel the difference between the tension and the relaxation. Tighten your fists while relaxing the rest of your body. Enjoy the sensation as you relax. Tense both arms. Relax them and rest them at your side.

Now concentrate on your feet and legs. Tense your body as you tensed your legs. Keep the rest of your body relaxed. Now relax your feet. Press your toes downward to tighten your calves and feet. Relax. Curl your toes to create tension in your shins. Relax. Tighten your buttocks and thighs by pressing down on your heels. Relax.

Now arch your lower back. Feel the tension in your spine. Relax. Next, breathe deeply, hold it and feel the tension. Exhale and relax. Breathe in and out slowly and feel how relaxing that is. Let the relaxation spread to your shoulders, arms, and back. Tighten your stomach. Relax. Shrug your shoulders and tighten your neck while bringing your shoulders up to your ears. Relax. Let your head fall forward and backwards. Feel the relaxation in your neck and in your entire body.

(Adapted from Nielsen, 1966)
APPENDIX F

Modified Vocal Rest Program

ADVANTAGES:
1. Vocal rest allows a quick reduction in size and severity of swelling in the voice box area, and along with this, an improvement in the quality of voice.
2. Vocal rest allows the patient to quickly determine the relationship between abusive behaviors and the abnormal voice.
3. Identification of situation specific vocal abuse.
4. Determine patient's commitment to the process of voice improvement.

DISADVANTAGES:
1. Financially impractical.
2. Difficult task.
3. Possible negative feelings if unable to complete period of vocal rest.

GUIDELINES FOR MODIFIED VOCAL REST
A. Conditions under which talking is permitted. Talking is permitted as long as the following rules governing conversation are strictly adhered to:
   1. Conversation should be limited to a total time of no more than 15 minutes per day.
   2. Each period of talking must be limited to no more than five minutes in duration.
   3. Conversations must be on a one to one basis in an environment with no background noise.
B. Activities to Avoid.
   1. Singing, whispering and humming are not permitted; and lifting, pushing and forceful elimination must be avoided.
C. Conditions under which coughing and throat clearing are permitted.
   1. Coughing and throat clearing are permitted as long as the silent cough/throat clearing method is used.

   procedure- push as much air as possible from the lungs short, blast-like bursts (the only sound produced should be a quiet rush of air benefits- the silent cough method prevents vocal fold adduction during coughing and throat clearing and it reduces the duration of the throat clearing

(adapted from Foothills Hospital program - Nielson, 1996)
REFERENCES


