2019-01-01

Listener Perception As A Measure Of Treatment Effectiveness In Voice Modification For A Transwoman

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LISTENER PERCEPTION AS A MEASURE OF TREATMENT
EFFECTIVENESS IN VOICE MODIFICATION FOR
A TRANSWOMAN

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Dedication

I dedicate this work to my son, John Charles, who was my reason and my motivation to keep fighting, even when things seemed impossible. May he always have this as a reminder of what hard work and perseverance can achieve.

I also dedicate this work to my parents, Juan and Amy Gutierrez. None of this would have been possible without their unwavering support throughout my life.

LISTENER PERCEPTION AS A MEASURE OF TREATMENT

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A TRANSWOMAN

by

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THESIS

Presented to the Faculty of the Graduate School of

The University of Texas at El Paso

in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF SCIENCE

Program in Speech-Language Pathology

THE UNIVERSITY OF TEXAS AT EL PASO

August 2019

Acknowledgements

Abstract

Purpose: The purpose of this study was to assess treatment effectiveness using listener perception as a measure of vocal femininity in a 22-year old transwoman.

Participant: The participant for this study was a monolingual, English-speaking, 22-year old transwoman. Inclusion criteria included self-identification as a transwoman. Exclusion criteria included surgical procedures to the vocal folds.

Methods: This cross-sectional survey study focused on using listener perception as a measure of treatment effectiveness in voice feminization. This study used surveys to investigate how naïve listeners would perceive the participants voice after she received voice modification treatment at the University of Texas at El Paso Speech-Language and Hearing Clinic.

Results: The initial survey revealed that while half of the listeners did identify the transwoman's voice as female, some listeners found her voice unpleasant; the listeners identified several factors that contributed to their negative perception. Adjustments were made to treatment and as a result, only two listeners in the subsequent described her voice as unpleasant.

Conclusions: The results of this study show that though this transwoman did not achieve a fundamental frequency in the traditional feminine range, her voice was still gendered female by the majority of the naïve listeners. The results of this study suggest that fundamental frequency should not be the primary measure of success in voice modification therapy for transwomen.

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Chapter 1: Literature Review

1.1 INTRODUCTION

The term *gender* refers to the social constructs of roles based on an individual's biological sex: anatomy, chromosomes, and hormones an individual is born with (Muehlenhard & Peterson 2011). An individual who identifies as transgender (TG) is born with the anatomy of one sex but identifies with the opposite gender role (Quinn & Swain, 2018). A TG individual's outward appearance does not match the gender they align with internally and they may transition, or present, as their gender of choice by: dressing and "presenting" as their chosen gender, electing to have gender confirmation surgery including undergoing cross-sex hormone therapy which alters male and female secondary sexual characteristics (Deutsch, Bhakri, & Kubicek, 2015). In addition to visual presentation, TG individuals may also seek ways to modify their voice to be perceived as their chosen gender. Female to male (FtM) transgender individuals also referred to as transmen may do so with cross-sex hormone therapy because the hormones used add mass to the vocal folds, giving them a deeper sounding voice. However, cross-sex hormone therapy does not affect the vocal folds of biological males; therefore, male to female (MtF) transgender individuals, also referred to as transwomen, must find other ways to obtain their desired voice. Because transmen's voices change with hormone therapy and therefore, they do not seek additional vocal therapy, the current study will focus on voice modification for transwomen.

1.2 VOICE AND GENDER PERCEPTION

Voice is the sound that resonates across the vocal tract. Voice, which includes pitch and resonance along with other less salient characteristics, plays a significant role in the quality of human communication and identity construction. Voice contributes to an individual's identity because in Western culture, the deeper the voice, the more masculine an individual while the higher the voice, the more feminine; therefore, voice is a significant marker of sex and gender.

Just as society has constructed and assigned certain behaviors and attributes to each gender, there are specific acoustic cues that listeners use to identify a voice as belonging to either a male or female speaker (Günzburger, 1995). For some transwomen, acquiring a feminine sounding voice is crucial to the transition process because if their voice does not match their appearance, they run the risk of being "clocked," which means to be misgendered, and are thus hindered in their attempts to pass as the gender with which they identify (Dacakis, 2002; Gelfer,1999; Hancock, Krissinger & Owen, 2011). When their voice does not match their physical presentation, transwomen may face adverse social consequences such as negative impact on employment and are at a higher risk of verbal and physical harassment (Quinn & Swain, 2018).

Speaking on the phone can be especially intimidating for transwomen because, without visual aid to assist with gender cues, they run the risk of being misgendered by the individual on the other end of the telephone (Andrews & Schmidt, 1997). Transwomen who feel that their voice does not match their identified gender may avoid situations in which they have to speak or socialize which can lead to self-isolation (White Hughto, Pachankis, Willie & Reisner, 2017). Studies have shown that misgendering may negatively affect transwomen's self-esteem which may lead to depression and isolation (Hyde, Doherty, Tilley, McCaul, Rooney & Jancey, 2013;

McLemore, 2015; Neumann & Welzel, 2004; Pasricha, Dacakis & Oates, 2009; White Hughto et al., 2017; Thornton, 2008).

Transwomen suffer more from depression than do transmen. A study by Hyde et al. (2013) examined the mental health and well-being of 946 TG individuals of which 482 were transwomen. Participants were recruited via social media and the distribution of flyers and posters to doctors and other service providers that work with TG individuals. The study was anonymous and completed online. Mental health and well-being were assessed using validated instruments such as the Patient Health Questionnaire, Body Image Quality of Life Inventory, and the National Drug Strategy Household Survey (Hyde et al., 2013). Several qualitative questions regarding experiences with healthcare, healthcare needs, factors contributing to mental health issues and factors that kept TG individuals from seeking healthcare services were also included.

Other questions included examining attitudes and evaluating experiences with the transition process, as well as experiences with discrimination and harassment (Hyde et al., 2013). Results from this study show that 57.9% of the 482 transwomen who participated in the study reported receiving a diagnosis of depression at some point in their lives including before or after their transition. When participants were asked to discuss factors that contributed to the state of their mental health, a common theme was concern about acceptance by society. When asked about factors that negatively contributed to their mental health, common themes were struggles with harassment, dealing with discrimination and the inability to progress with the transition process.

This study suggests that any barrier to the transition process that prevents transwomen from being accepted as their chosen gender may put them at risk for depression and isolation. When voice does not match the outward presentation, transwomen experience significant barriers

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including misgendering and lack of acceptance in society as their chosen gender (Hyde et al., 2013; King, Brown, & McCrea, 2012; Neumann & Welzel, 2004; Pasricha et al., 2008). Obtaining a voice that is perceived as feminine may positively affect the quality of life (QoL) for transwomen (Hancock et al., 2011).

Hancock, Krissinger, and Owen (2011) investigated the correlation between femininity, likeability, and QoL. In their study, transwomen rated their voices and completed the Transgender Self-Evaluation Questionnaire (TSEQ). The TSEQ is a self-report questionnaire that measures voice related QoL. Results show that QoL scores improved as the transwomen rated their voices more feminine. These results suggest that QoL for transwomen is affected by how they feel about their voice, and whether they perceive it to be feminine. Transwomen may, therefore, search different avenues to assist them with voice modification to match their chosen gender (Thornton, 2008; Van Borsel, Eynde, De Cuypere, & Bonte, 2008).

1.3 VOICE MODIFICATION TREATMENT FOR TRANSGENDER WOMEN

Cross-sex hormone therapy, which is the use of estrogen to develop female secondary sex characteristics, (Deutsch et al., 2015) does not affect the vocal folds of transwomen (Song & Jiang, 2017). Therefore, transwomen may choose to alter their speaking voices through surgery, voice modification therapy, or on their own by using videos found on the internet. Some transwomen will elect to undergo phonosurgery to elevate the pitch, or fundamental frequency (F^0) of the voice (Casado, O'Conner, Angulo & Adrian, 2016; Gelfer & Schofield,2000; Mastronikolis, Remacle, Biagini, Kiagiadaki, & Lawson, 2013; Van Borsel et al., 2008). One example of this type of surgery is cricothyroid approximation, in which sutures are used to simulate cricothyroid muscle contraction (Van Borsel et al., 2008). Another popular option for

transwomen to increase their F^0 is the Wendler glottoplasty. Wendler glottoplasty is a procedure in which the vocal folds by a CO2 laser which de-epithelializes the anterior commissure along with the anterior two-thirds of the vocal folds (Mastronikolis et al., 2013).

In a less invasive procedure, a surgical technique called Laser Assisted Voice Adjustment (LAVA) the vocal folds are made more rigid as well as reduced in mass, elevating F^0 (Casado et al., 2016). However, some transwomen may not be able to afford surgery or may be uncomfortable with the risks of surgery. Therefore, many transwomen attempt to modify their voice on their own by exaggerating their "female sounding" voice which may be perceived as overly high pitched or breathy (Gelfer & Schofield, 2000). Attempting to modify the voice in this manner may be phonotraumatic (Dacakis, 2000; Neumann & Welzel, 2004). Phonotrauma refers to inflammation, irritation or any damage to the vocal folds caused by vocally abusive behaviors (Behrman, Rutledge, Hembree, & Sheridan, 2008). Therefore, it may be beneficial for transwomen to modify their voice through a structured voice modification program.

For transwomen, modifying the voice to match the chosen gender is possible through an individualized and structured voice modification program (Gelfer, 1999). Voice modification therapy for transwomen typically targets fundamental frequency (F^0) (Gallena, Stickels & Stickels, 2017; Gelfer, 1999; Gelfer & Schofield, 2000; Mount & Salmon, 1988; Thornton, 2008; Wolf, Ratusnik, Smith & Northrup, 1990). The average speaking fundamental frequency (SFF) for biological males is between 100-146 Hz. The average SFF for biological females is between 188Hz-221Hz (Gelfer & Mikos, 2005). Several studies using listener judgments of gender-based on audio voice recordings found that transwomen need to maintain a SFF above 160 Hz for the voice to be identified as female (Gelfer, 1999; Gelfer & Schofield, 2000; King et al., 2012, Spencer, 1988; Wolfe et al., 1990, Van Borsel, De Cuypere, Van der Berghe, 2001). However,

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for some transwomen, reaching a SFF of 160 Hz requires a significant effort. This increase in F^0 may compromise the vocal quality. That is, the vocal quality may become harsh. For this reason, some studies suggest an initial target of 155–165 Hz, which is in the gender-neutral range (Gelfer,1999; Gelfer & Schofield, 2000; Mount & Salmon, 1988; Thornton, 2008; Wolf et al., 1990). Furthermore, targeting F^0 exclusively in voice modification may result in a voice that is too high pitched and thin in resonance. This in turn produces a voice that mimics that of an "effeminate male" (Dacakis, 2000).Therefore, the literature suggests that resonance should also be targeted (Carew, Dacakis, & Oates, 2007; Coleman, 1971; De Bruin, Coerts, & Greven, 2000; Gelfer & Bennett, 2013; Gunzburger, 1995, Mount & Salmon, 1988).

Resonance is defined as the acoustic signal that is determined by the shape of the vocal tract (Simpson, 2001; Quinn & Swain, 2018). Resonant frequencies are referred to as formants and are predominantly detectable in the vocalic parts of speech (Gelfer & Bennett, 2013; Gunzberger, 1995). The vocal tracts of biological males are longer than those of biological females. This results in formant frequencies that are lower than those of biological females (Carew et al., 2007; Gelfer & Bennett, 2013; Mount & Salmon, 1988). Therefore, resonance may provide cues for gender identification of the voice (Coleman, 1971; Coleman,1976; Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009; Mount & Salmon, 1988).   For example, several studies that utilized synthetic, synthesized or digital sources to alter F^0 and formant frequencies of participants found that altering F^0 and formant frequencies alone is not effective in changing perception of voice gender and suggest that raising both F^0 and formant frequencies together may result in the perception of a female voice. (Assmann, Nearey, & Dembling, 2006; Coleman, 1971; Coleman, 1976; Gallena et al., 2017; Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009; Skuk & Schweinberger, 2014). Furthermore, these studies suggest formant frequencies may play

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a more crucial role for voices that have a F^0 in the gender-neutral range (Assmann, Nearey, & Dembling, 2006; Coleman, 1971; Coleman, 1976; Gelfer & Bennett, 2013; Hillenbrand & Clark, 2009).

Raising formant frequencies or resonance is done by changing the locus of resonance from a back resonance to a forward focused resonance, or more specifically, the chest to the head (Thornton, 2008). This may be done through modification of the tongue carriage to an anterior position, elevation of the mandible, and retraction of the lips, a technique known as lip spreading (Carew et al., 2007; Gunzberger,1995; Mount & Salmon, 1988; Quinn & Swain, 2018). Carew et al. (2007) and Mount and Salmon (1988) targeted resonance in their studies and showed an increase in perceived femininity for transwomen after modifications were made to the locus of resonance using anterior tongue carriage.

Other studies have focused on additional features of speech and voice that may contribute to the perception of the voice as female (Dacakis, 2002; Gelfer,1999; Gunzberger, 1995; Oates & Dacakis, 1983; Simpson, 2001; Thornton, 2008; Wolfe et al.,1990; Van Borsel, Janssens, & De Bodt, 2007). Some studies have found that women have more intonation changes in their speech patterns than men (Thornton, 2008; Wolfe et al.,1990). Specifically, pitch range is more dynamic in women, and women tend to rise in pitch at the end of sentences (Quinn & Swain, 2018). Some research suggests that breathiness is a useful voice quality for transwomen to obtain because it may contribute to the perception of femininity (Dacakis,2002; Gorham-Rowan & Morris, 2006, Klatt, 1987; Mount & Salmon, 1988; Van Borsel et al., 2007). A review of the research mentioned thus far indicates that F^0, resonance, intonation and breathiness are all qualities of the female voice that may be considered in voice modification for transwomen.

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While the literature suggests that a voice modification treatment should include changes to F^0 along with resonance, intonation and voice quality, the efficacy of voice modification treatment for transwomen has not been fully investigated and of those that have examined efficacy, little consensus exists. For example, increase of F^0 within the female range is sometimes used as measurement of treatment outcomes because the literature has found a positive correlation between F^0 and perception of vocal femininity (Dacakis, 2000; Gelfer, 1999; Gelfer & Schofield, 2000; King et al., 2012; Soderpalm, Larsson & Almquist, 2004, Van Borsel et al., 2001). For example, Wolfe, Ratusnik, Smith and Northrop (1990) recorded 20 transwomen who gave conversational responses to questions about home and work. Perceptual measures used to judge the recordings were categorization of the speakers as male or female, and ratings on a scale of masculinity-femininity (Wolfe et al., 1990). The transwomen who were categorized as having female sounding voices had a mean F^0 of 171.8. A later study by Van Borsel et al., (2001) investigated the correlation between physical appearance and voice. They found that when visual cues were not available, a higher F^0 was correlated with a rating of femininity on a visual analogue scale (VAS) (Van Borsel et al., 2001).

A more recent study by King et al. (2012) presented 20 naïve listeners with recordings of the Rainbow Passage read by 21 transwomen and 9 biological females. The listeners rated the recordings on a 7-point scale of femininity-masculinity, similar to the one used in the study by Wolfe et al. (1990). The transwomen identified as females had a mean speaking F^0 range of 171-205 Hz. The abovementioned studies implicate F^0 as a significant acoustic marker for gender. Some studies showed that when F^0 increased, transwomen were more satisfied with their own voice, and investigated this through subjective measures such as questionnaires and surveys (Dacakis, 2000; Soderpalm et al.,2004;Wagner, Fugain, Monneron□Girard, Cordier, &

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Chabolle, 2003;Yang, Palmer, Meltzer, Murray, & Cohen, 2002). For example, Dacakis (2000) examined F^0 of 10 transwomen, pretreatment, at discharge and over the course of 4 years posttreatment. The group mean F^0 were 125.5 at initial consultation, 168.1 at discharge and 146.5 at follow up (Dacakis, 2000). A visual analogue scale (VAS) consisting of a line 100mm in length with not at all satisfied printed on the extreme left and completely satisfied printed on the extreme right, was employed to compare the transwomen's satisfaction with their voices pre and post treatment (Dacakis, 2000). The 10 transwomen indicated their satisfaction by marking a point on the line, and all but one expressed high degrees of satisfaction with the increase of F^0 at discharge, as well as at follow up (Dacakis, 2000).

In a different study, Soderpalm, Larson and Almquist (2004) presented 14 transwomen with interview questions regarding satisfaction with their voice after the transwomen had completed voice therapy or underwent phonosurgery to increase F^0. More than half of these transwomen reported their voice agreed with their personality post intervention (Soderpalm et al., 2004). Similarly, Wagner, Fugain, Monneron Girard, Cordier, and Chabolle (2003) investigated the relationship between elevated F^0 and patient satisfaction in their study in which 14 transwomen gave subjective ratings of satisfaction after they underwent pitch-raising surgery. Results of this study showed 78.5% of these patients gave ratings of "very satisfied" or "satisfied" (Wagner et al., 2003). Yang, Palmer, Meltzer, Murray and Cohen (2002) gathered subjective data via surveys they sent to transwomen who underwent cricothyroid approximation surgery, and the majority of these transwomen reported satisfaction with their voice and felt their voice was more feminine. The results of the studies mentioned above suggest raising F^0 may be correlated with voice satisfaction in transwomen, indicating F^0 as a measure of treatment effectiveness. However, a study by McNeill, Wilson, Clark, and Deakin (2008) evaluated the

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relationship between F^0 and voice satisfaction for transwomen. In this study, 12 transwomen completed VASs, and results failed to show a significant relationship between F^0 and satisfaction with voice (McNeill et al., 2008). Therefore, it was concluded that subjective measures of satisfaction may prove to be a more valuable measure of treatment outcomes than increase in F^0 alone.

While some researchers maintain that subjective measures of patient satisfaction such as VASs are valid and reliable tools in evaluating treatment effectiveness in voice modification for transwomen (Mcneill et al., 2008), others suggest this method may not be reliable because for transwomen, their experience of their voice is dynamic and dependent on factors such as mood, motivation levels, conversation topics, or any communicative situation that may arise (Pasricha et al., 2008). Pasricha, Dacakis and Oates (2008) conducted a study with the aim of gaining better understanding of the way different situations affect the way transwomen feel about their voice. The authors utilized the Functional Communicative Satisfaction Questionnaire (FCSQ) and found that environmental variables such as level of intimacy, formality of the situation and the context of the interaction impacted communicative satisfaction for the transwomen in this study (Pasricha et al., 2008). As a result, other measures such as listener perception of voice have been suggested as one that could potentially serve as an optimal measure of treatment effectiveness.

1.4 LISTENER PERCEPTION AS A MEASURE OF TREATMENT EFFECTIVENESS

Recent studies have indicated listener perception as a more appropriate measure of treatment effectiveness rather than elevated F^0 on its own. Evidence of this can be found in a study by Gelfer and Schofield (2000) in which they investigated the differences in speaking F^0

between transwomen perceived as male versus those perceived as female. Gelfer and Schofield (2000) recorded 15 transwomen individually reading the Rainbow Passage, and presented the recordings to 20 undergraduate psychology students. Gelfer and Schofield (2000) anticipated that 6 of the transwomen would be perceived as female because these women had speaking F^0s above 170 Hz. However, only 2 of the 6 transwomen were perceived as female, adding to the evidence that F^0 alone is not an effective measure of treatment outcomes and listener perception is an important measure to consider.

Gallena, Stickels and Stickels (2018) utilized listener perception as a measure of voice femininity and masculinity. Listeners were presented with the voice samples that belonged to one biological male and one biological female (Gallena et al., 2018). The male voice sample was digitally manipulated to match the woman's formant frequencies (Gallena et al., 2018). The listeners changed their ratings of vocal femininity and masculinity based on the changes made to formants adding to the evidence that listener perception as an important measure of vocal femininity (Gallena et al., 2018).

Gelfer and Tice (2013) used 2 groups of listeners to evaluate gender and provide masculinity and femininity ratings of speech samples provided by 5 transwomen pretreatment, at termination of treatment and at follow-up. Perceptual results revealed the transwomen were perceived as female 1.9% of the time prior to treatment, more than 50% of the time immediately after treatment and 33.1% of the time at follow-up. According to Gelfer and Tice (2013), a rating scale of masculinity and femininity is helpful in the tracking progress of voice modification for transwomen, however, a voice can be described as "very feminine" while still being identified as belonging to a male. Likewise, a voice can be described as sounding "very masculine" and still be identified as belonging to a female. They suggest that the perception of voices as feminine or

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masculine are psychological constructs that are related but separate from gender identification (Gelfer & Tice, 2013). They maintain that while listeners' identification of gender based on voice without visual presentation is not an entirely accurate measure of how well speakers are gendered correctly, it is the most rigorous test for measuring treatment success in voice modification therapy for the transwoman (Gelfer & Tice, 2013).

Additionally, there is a paucity of information available regarding the effects of listener perception of voice on quality of life or satisfaction with treatment outcomes for transwomen. (Hancock et al., 2011; Mcneil et al., 2008). Hancock, Krissinger and Owen (2011) expanded on a study by McNeil et al. (2008), that found implementing measures of listener perception could contribute to improved quality of life for transwomen. In their study, Hancock et al., recorded speech samples from 20 transwomen and presented the audio recordings to 25 undergraduate student listeners who rated the voices for femininity and likeability (Hancock et al., 2011). Results showed that for these transwomen, QOL was moderately correlated with how others perceived their voice. This study complements the study by McNeill et al. (2008), which implicates listener perception as a valuable measure of treatment effectiveness in terms of how treatment influences QoL (Hancock et al., 2011).Furthermore, findings indicate that if an individual is gendered correctly based on their voice, and their voice is "liked" by outside listeners, treatment may be considered effective due to the resulting client satisfaction with their voice.

1.5 PURPOSE OF STUDY

The purpose of this study is to assess listener perception as a measure of vocal femininity in a 22-year old transwoman. Because obtaining a voice that is perceived by others as female is

vital to a healthy transition phase for transwomen and because failing to align their voice with their new gender may negatively influence the way in which transwomen perceive themselves, the goal of many transwomen is to present with a voice that does not draw negative attention and lessens their chances of being misgendered (Dacakis, 2002; Gelfer,1999; Hancock et al., 2011; Hyde et al., 2013; King et al., 2012; Neumann & Welzel, 2004; Pasricha et al., 2008). This study found that for this participant, listener perception helped to identify qualities of the voice that may draw negative attention and assisted the PI in adjusting treatment to address these issues. Furthermore, this study showed that the participant was identified as female even though she had not reached the prescribed range for vocal femininity. Results indicate that for listener perception was the optimal measure of treatment effectiveness in voice modification for the participant, rather than tracking F^0 alone. Therefore, this study is important to understanding how speech language pathologists may identify individual complexities and assist transgender women in voice presentation. This study also provides insight into the use of subjective measures that indicate progress and appropriate time for discharge.

Chapter 2: Methods

2.1 STUDY DESIGN

This was a cross-sectional survey study that focused on using listener perception as a measure of treatment effectiveness in voice feminization. This study employed the use of surveys to investigate how naïve listeners would perceive the participant's voice after she received voice modification treatment at the University of Texas at El Paso Speech-Language and Hearing Clinic. Approval was obtained by the University of Texas Institutional Review Board committee before commencement of the study.

2.3 PARTICIPANT

The participant for this study was a monolingual, English-speaking, 22-year old transwoman. Inclusion criteria included self-identification as a transwoman. Exclusion criteria included any surgical procedures to the vocal folds for the purpose of raising pitch. At the time of this study, the participant had been presenting as female 100% of the time for two years and self-reported a diagnosis of gender dysphoria for which she received counseling services. The participant reported undergoing medically supervised endocrine therapy. The participant passed a hearing screening at 25dB HL for 1000 Hz, 2000 Hz, and 4000 Hz in each ear, per ASHA standards (American Speech-Language Hearing Association, 1997). Participant previously received voice modification treatment at The University of Texas at El Paso for four academic semesters. During this time, FF and resonance were targeted.

2.4 Naïve Listeners

As part of this study, six males and five females were recruited to serve as the naïve listeners. The naïve listeners were divided into two groups. Inclusion criteria included no knowledge of voice modification in transgender individuals. Exclusion criteria included knowledge of voice modification in transgender individuals and/or being in the speech pathology field.

2.5 Procedures

Lessac-Madsen Resonant Voice Therapy (LMRVT) is a physiologically based treatment approach in which an individual phonates using little respiratory effort and receives proprioceptive feedback via the sensations on the alveolar ridge and facial bones (Yiu, Lo, & Barrett 2017). LMRVT consists of phases. In the Basic Training Gesture (BTG), Phase 1 of LMRVT, an individual is taught to produce voice on very simple sounds, with resonance focused in the facial mask (Sapienza & Ruddy, 2018). The participant in this study received voice modification treatment that targeted resonance and F^0 simultaneously. Treatment included use of a modified LMRVT approach Basic Training Gesture (BTG), Phase 1 as described by Adler, Hirsch, & Mordaunt (2012). The participant's F^0 plateaued in the range of 150 Hz-156 Hz; therefore, another measure of treatment effectiveness was needed. The use of surveys to investigate listener perception of the participant's voice was employed.

A one-minute speech sample was obtained from the participant after nine treatment sessions of voice modification. Another one-minute speech sample was obtained after an additional eight treatment sessions. The speech samples were recorded in a quiet clinic room using a laptop computer equipped with PRAAT Software. PRAAT software finds the means of

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speech samples. In the current study, the mean F^0 of the first speech sample was 151 Hz. The mean F^0 of the second speech sample was 154 Hz. The topics for the speech were chosen so that they did not contain any gender clues.

Five questions were created to assess the voice in the speech samples. The questions included:

1. How would you describe the quality of this person's voice?

2. How old would you say this person is?

3. Was this voice pleasant or unpleasant?

4. If the voice was unpleasant, why?

5. What gender would you say the person on the speech sample is?

2.6 Naïve Listener Speech Sample Response Procedure

The first survey was presented to the first group that included two males and four females who were blinded to the gender and age of the participant. To minimize biases, the PI left the room while the participants listened to the speech sample. Once the naïve listeners were done listening to the speech sample, the PI returned to the room and asked the survey questions. If the gender of the voice was not disclosed via the use of pronouns in their responses, a final question regarding the gender of the voice was asked.

Five weeks after the participant received eight additional treatment sessions, a second group of naïve listeners consisting of four males and one female were presented with the same survey questions listed above, except for question five. In this group, gender identification was elicited by listing the terms "male" and "female" on the top of the survey. The procedures outlined above remained the same however, the survey questions were left in the room. Naïve listeners were instructed to fill out the survey questions after they listened to the 1-minute speech

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sample. They were also instructed to circle the gender they believed best described the voice. No additional instructions were given to the naïve listeners.

Chapter 3: Results

The purpose of this cross-sectional survey study was to determine whether listener perception was an optimal measure of vocal femininity and of treatment effectiveness in a 22-year old transwoman. Responses to the survey questions show similarities across this group of naïve listeners. The qualitative data obtained from the surveys were used to identify voice characteristics that contributed to listener perception of vocal femininity or masculinity.

In the first group of naïve listeners, a final question regarding the gender of the voice was asked to 4 out of the 6 participants because two participants used the pronoun "she" when responding to the first 3 questions. The speech sample was gendered female by a total of three out of the six naïve listeners. One naïve listener reported that the voice on the speech sample sounded "like a man trying to sound like a woman; like a transgender person." Two of the naïve listeners identified the speech sample as male. Five out of the six listeners rated the voice as unpleasant due to dysfluent speech such as interjections, slow rate of speech and hyponasality. In addition, the voice on the speech sample was described as raspy, hoarse and shaky.

Table 1. Results of Survey Group 1

Participants	Voice Quality	Age	Pleasant/ Unpleasant	If Unpleasant, Why?	Male/Female
P1	muffled, sounded like a voice changer	Mid 20's	Unpleasant	"There was something about it. Can't put my finger on what it was."	Unable to decide
P2	nasally, slow	Late 30's early 40's	A little unpleasant	Sounded "automated"	Transgender female
P3	Creaky, shaky	Late 30's	Unpleasant	Long pauses in speech and the "uncertainty"	Female
P4	Normal	20's	Neutral	Question not asked because voice was described as neutral.	Male
P5	Hoarse, slurred	20's	Unpleasant	"struggling to say what **she** wanted to"; slurring.	Question not asked due to use of female pronoun in question 4.
P6	Raspy, delayed, took a long time to formulate words, said a lot of ums. "**She** never got to the purpose. **She** sounded like **she** had the flu."	20's, 30's	Unpleasant	"I could tell right away that something was wrong."	Question not asked due to use of female pronoun in question1.

A second group of naïve listeners was surveyed five weeks after the participant received eight additional sessions of voice modification treatment. Treatment was modified based on the answers to the first group of surveys and targeted other female characteristics of speech such as intonation and breathiness. The clinician targeted these characteristics to address unpleasant voice qualities that were mentioned in the first group of surveys.

The second group of naïve listeners consisted of four females and one male. The voice on the speech sample was gendered female by three of the five naïve listeners. One of the male naïve listeners reported that he could not determine whether the voice belonged to a male or a female. One listener identified the voice as male. This group of naïve listeners described the voice on the speech sample as creaky, squeaky and high pitched. One naïve listener described the

voice as nasally. A different naïve listener described the voice as sounding clear and loud while another listener described the voice as "low in volume." Interestingly only two out of the five naïve listeners rated the voice as "unpleasant." One of these two naïve listeners listed "high pitch" and fast rate of speech as contributing to the unpleasantness of the voice. The second naïve listener reported that he found the voice to be unpleasant because the speaker was audibly "upset." Table 2 shows the responses.

Table 2. Results of Survey Group 2

Participants	Voice Quality	Age	Pleasant/ Unpleasant	If Unpleasant, Why?	Male/Female
P1	It sounds kind of creaky.	43	"I wouldn't say unpleasant…"	"hard to tell who I'm listening to."	"can't distinguish male/female"
P2	"creaky at times;" hoarse, squeaky.	22	Unpleasant	"High pitch; very fast"	male
P3	Clear and loud	26	Unpleasant	"The person was upset, and one can relate to the content."	Female
P4	Nasally	27	Pleasant	Voice described as pleasant	Female
P5	Squeaky, high pitched, light, low volume, forced.	Early to mid 20's	"normal"	Voice described as normal.	Female

Chapter 4: Discussion

The research concerning discharge procedures for trans people is lacking. Fundamental frequency (F^0) is an important factor but is not enough to ensure that the transwoman will be accepted in society as a woman, or that she will be able to accept herself. In addition to sparse objective discharge measures, there is lack of consensus regarding measures of treatment effectiveness in voice modification for transwomen (Gelfer, 1999; McNeill, 2006). Many studies support that F^0 at or above 160 HZ is the most significant acoustic marker for a voice to be perceived as female (Gelfer, 1999; Gelfer & Schofield, 2000; King et al., 2012, Spencer, 1988; Wolfe et al., 1990, Van Borsel et al., 2001). However, this study revealed that though the transwoman did not achieve an F^0 in the feminine range, she was still identified as female by more than half of the naïve listeners in both survey groups. Initial treatment has traditionally been to bring a participant into the range 160-165Hz. This study shows that this transwoman with a range of 150-154Hz could pass as a woman more naturally than a when she tried to reach the traditional range. More research is needed to see if these results replicate to the general population of transwomen.

The prescriptive goal range for discharge may be higher than necessary. The purpose of this study was to assess listener perception as a measure of treatment effectiveness in voice modification therapy for a transwoman while adding to the evidence that elevated F^0 is not an effective measure of treatment effectiveness on its own. This finding adds to the research that has found F^0 should not be utilized as the only measure of treatment effectiveness and listener perception should be considered as a measure of treatment outcomes (Gelfer and Schofield, 2000; Gelfer & Tice, 2013; Gallena et al., 2018; Hancock et al., 2011; Mcneil et al., 2008). If F^0

alone should not be the determining discharge factor, further research should explore what other factors can predict a post-discharge integration into society.

Even though the participant's voice was gendered correctly, one could argue that treatment may have not been effective due to the resulting unpleasant voice. Conversational speech samples that were presented to listeners in this study had mean F^0 of 151 Hz and 154 hz respectively, yet this transwoman was gendered female over 50% of the time in both survey groups. Nevertheless, in the first survey group, the transwoman's voice was described as "unpleasant" by all but one listener. As mentioned in the literature review, the goal of many transwomen is to not only present with a voice that corresponds with their chosen gender but also a voice that does not draw negative attention (Dacakis, 2002; Gelfer,1999; Hancock et al., 2011; Hyde et al., 2013; King et al., 2012; Neumann & Welzel, 2004; Pasricha et al., 2008). Gaps in understanding perceptions of voice and the presentation of intentionally developed gendered voices also provides room for further research into transwomen's transition process.

The factors that constitute voice are myriad. Some participants in the study who listened to the transwoman's voice found her voice unpleasant. Several vocal characteristics were implicated as reasons why the listeners found the voice unpleasant. As a result, adjustments were made in treatment. After eight more weeks of treatment, a new sample was presented to a different group of listeners and only two of the five listeners described the voice as unpleasant. This indicates that because appropriate changes were made to treatment based on the initial surveys, the transwoman's voice quality may have improved. Therefore, her voice was perceived as more pleasant than before. This study shows that all aspects of voice should be considered before discharge and that significant subjective measures, like outside feedback of naïve listeners, will guide speech pathologists in making effective treatment plans. Further research

into vocal factors will ensure that transwomen will be accepted in society and, most important, learn to accept themselves.

4.1 LIMITATIONS

There is a lack of research that has assessed listener perception as a measure of treatment effectiveness for transwomen. The results of this study show that for this transwoman, listener perception gave important information about treatment effectiveness. Over half of the naïve listeners in this study judged the participant's voice as female, even though her FF was not in the female range, indicating other vocal characteristics as being important in the perception of vocal femininity.

However, this study has limitations which do not allow the results to be generalized to the greater population of transwomen. First, only 11 total naïve listeners were used in this study. Had the PI recruited a larger number of naïve listeners, results may have been different. Furthermore, the PI did not collect demographic data on the naïve listeners. Another limitation is the use of PRAAT software. The speech samples presented to the unfamiliar listeners could have been distorted by the PI's computer, or the software itself. The use of this technology could have contributed to the "automated" or "unpleasant" qualities described by some of the listeners. It can be hypothesized that if a higher quality recording had been presented to the listeners, the participant's voice would not have been rated as unpleasant by some of the listeners.

4.3 CONCLUSION

The results of this study show that though this transwoman did not achieve a F^0 in the feminine range, her voice was still gendered female by the majority of the naïve listeners. The

results of this study also suggest that F^0 should not be the primary measure of success in voice modification therapy for transgender individuals. These findings are promising for those transwomen who may be unable to reach a F^0 in the female range. While a higher F^0 may result in a voice being perceived as female, this may not be enough to conclude that treatment was successful if the voice has an unpleasant quality. The information obtained from the surveys assisted the PI in decision making regarding voice modification treatment for this transwoman. The information also gave insight into the complexity and variables involved in achieving a female-identified voice. Future studies should investigate listener perception as a measure of treatment effectiveness using a larger number of unfamiliar listeners. Such research will further allow speech language pathologists opportunities to make a vast difference in a highly marginalized population.

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Appendix

Survey Presented to Naïve Listeners

Sample voice: M/F

The University of Texas at El Paso
Speech, Language and Hearing Clinic

1. How would you describe the quality of this person's voice? (e.g. hoarse, creaky, etc.)

2. How old would you say this person is?

3. Was this voice unpleasant or pleasant? If unpleasant, why?

Vita

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During her time at the University of Texas at El Paso, she has had the privilege of presenting a poster based on this thesis at the 2018 American Speech-Language-Hearing Association Annual Convention in Boston, Massachusetts. Her research was also accepted for presentation at the 2019 National Transgender Health Summit in Oakland, California.

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