ISSN: 2635 - 2826

Journal of Clinical & Biomedical Research

SCIENTIFIC Research and Community

Research Article

Open Access

Application of Low Intensity Laser Associated with Exercise with High-Strength Tube in the Vocal Treatment of Transgender Women: Pilot Study

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ABSTRACT

Introduction: Voice is a determining factor for transgender women to be able to communicate and be recognized by the other as belonging to the desired gender. In voice clinic, exercises of semi-occluded vocal tract and technological resources that act in an adjunct manner are used, aiming to promote better phonatory adjustments, raising the fundamental frequency and vocal tract adjustments such as resonance, intensity, articulation, speed, among others. The work of the speech therapist requires an expanded vision, seeking the integration between voice and body. The present study seeks to understand how the modulation process for acute pitch occurs upon using exercise with a high-strength tube associated with the therapeutic resource of low intensity laser, aiming to evaluate the effectiveness of these two tools when used simultaneously.

Material and Methods: The research was based on a case study of a transgender woman. The therapy was based on the application of low intensity laser associated with the use of exercise with high strength tube. The study was approved by the Research Ethics Committee and the participant signed the Informed Consent Form. Anamnesis, application of the Transsexual Voice Questionnaire (TVQ) and evaluation before and after the application of the techniques were performed, through acoustic analysis of the vocal signal and auditory-perceptive evaluation, through the Vocal Profile Analysis (VPA) Protocol.

Results and Discussion: There was an increase in variability in the categories of pitch and loudness, absence of crackling and improvement in energy distribution after therapy. The patient used greater voice breathing and there was a predominance in the distribution of articulatory adjustments.

Conclusion: Speech therapy promoted an election of the vocal pitch, modified the characteristics of vocal quality and dynamics and generated a sound fluency for the female. It was possible to observe that the greatest change occurred in an auditory way, interfering in the acoustic impression that the other has in relation to this voice, that is, the greatest gain was in the sound filter.

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Received: November 04, 2020; **Accepted:** November 10, 2020; **Published:** November 20, 2020

Keywords: Speech Therapy. Laser Therapy. Voice Training. Transgender People.

Introduction

The human being socially categorizes gender as man and/or woman. Culturally, we are differentiated in feminine and masculine aspects, which is the role of gender. These rules are implicitly inserted in our environment through image, behavior and voice [1].

Those who do not fit need to adjust to feel accepted, as is the case of the transgender public, who do not identify with the biological sex. Some people are born with the male sex, although recognize themselves in the female gender, which constitutes the transgender woman [2].

Voice is a determining factor capable of identifying the gender of the speaker. The female fundamental frequency is around 145-275 Hz and the male frequency is between 80-165 Hz. For a male voice to be recognized as female, there must be an elevation above 150-160 Hz [3].

Speech also plays an important role, because it allows us to transmit traits of our personality, psychological and emotional aspects. It has variations that differ from the male voice to the female voice, such as: speech speed, intonation, intensity, pitch, among other suprasegmental factors. Therefore, a voice that resembles one's new gender identity brings positive aspects, improving the self-perceived quality of life. While an incoherent voice can generate a feeling of inadequacy, causing a negative reaction [2].

Approximately 46% of transgender women seek voice feminization service, because even if they use hormone therapy, no hormone alone is capable of raising the fundamental frequency, reducing vocal fold mass or has a lasting effect on pitch [4,2].

Speech-language pathology treatment in vocal confirmation requires an expanded view, seeking a support between gender identity and its representation in the female role through voice, providing a balance between body and voice [5].

The main objectives of this individualized therapeutic proposal are: change in vocal adjustment, pitch elevation, intensity and frequency of formants [6].

It is possible to achieve these changes through technological resources associated with adequate vocal exercises. In voice clinic, half-occluded vocal tract exercises (SOVTE) are used, which should be performed with some type of vocal tract occlusion, with the main objective of promoting the interaction between source (vocal folds) and filter (resonance), favoring vocal performance [7].

Low intensity laser (LIL) is also used, which contributes to increasing cellular resistance and vitality, stimulating the tissues to a rapid return to their functional normality, providing the patient with a feeling of relief soon after its application, thus accelerating his/her rehabilitation [8].

The high-strength tube is a variation of SOVTE, produces an increase in intraoral pressure, decreases effort in the glottis source, promoting better vocal performance, elevation of the fundamental frequency, vocal flexibility and a speech with decreased effort and greater clarity [9].

The Low Intensity Laser is an alternative and noninvasive therapeutic resource, and has analgesic, anti-edematous, healing, biomodulator, muscle injury repairing and peripheral nerve regenerating effects [1,10,11,12].

It is considered an important alternative in the treatment of inflammatory processes, accelerating healing, pain reduction, resulting in increased blood circulation and better muscle performance [13].

Communication is part of the life of the human being, this language, whether verbal or nonverbal, allows us to provide the other with the information of what we want to interact with. Several factors are taken into consideration during a conversation, especially when no visual clues are provided. Even if the speaker is a stranger, the listener can have evidence concerning the gender. The way this voice is perceived helps in the transition process of transgender women and improves their self-perceived quality of life [2].

Biological factors, social pressure, the media and cultural patterns are components that induce the vocal image of people [1].

Being recognized by the other as belonging to the gender that is desired, through a conversation, a call or job interview, is another obstacle that transgender women need to overcome [4].

The role of the speech therapist goes beyond vocal work, also worrying about speech, the choice of words, posture, respiratory pattern, facial expression, gaze, gestures, all these aspects are important forms of communication [14].

This effort is justified since no studies were found associating the resource of low-intensity laser with exercise with high-strength tube, making it necessary to understand how the modulation process for acute pitch occurs in transgender women, upon using these two techniques concomitantly.

In view of the above, the objective of the research is to evaluate the effectiveness of exercise with a high-strength tube correlated with the therapeutic resource of low-intensity laser in modifying the vocal quality of a transgender woman.

Material and Methods

This research is a case study of a transgender woman, whose participation was approved by the Human Research Ethics Committee, under the number: 2.376.533. The participant received clarification and agreed to participate voluntarily, signing the Informed Consent Form.

The sound was recording, with the emission of the months of the year and chained speech, with a digital recorder (Sony, Model ICD-PX470), positioned 10 cm away towards the patient's mouth, the stored signal had its initial and final parts cut, the analyses were made before the techniques and after eight sections, being performed once a week. The recordings were submitted to vocal acoustic analysis in voxmetria 2.7 (CTS Informática) and auditory-perceptive analysis, through the Vocal Profile Analysis (VPA) Protocol, by John Laver (1980), translated and adapted for the Brazilian Portuguese by Camargo and Madureira (2008). The VPA was conducted by two voice expert judges.

Specific exercises were worked for pitch elevation and fundamental frequency of the patient exclusively part of this research.

The participant received a rigid plastic straw of 8.7 cm in length and 1.5 mm in diameter, being instructed to keep it between the lips, slightly occluded and vocalize the sound of the vowel [U], in high frequency and comfortable intensity. After the demonstration of the exercise, the participant was asked to perform the sound for three minutes, breathing when necessary, and, simultaneously, the laser was applied with the time of four joules, infrared wavelength, in four points of the larynx: higher region of the thyroid cartilage, cricothyroid space and in the cricothyroid muscle.

Case Description

D.F., 20 years old, student, sought the aforementioned outpatient clinic with the following complaint: "my voice does not suit me" (SIC). According to the patient, her voice is too deep, which makes her feel embarrassed when she needs to speak in public. "I avoid communicating more and more every day, because I do not feel comfortable when I have to express myself" (SIC). Regarding vocal health, D.F. denies the use of cigarettes and alcoholic beverages. Her last videolaryngostrostroboscopy examination revealed that she had no laryngeal alterations, especially related to vocal folds. The patient reports that, when she speaks on the phone, people get confused about how to treat her, even when she says her social name. Her expectation is "to have a higher-pitched voice that matches her physical appearance" (SIC).

In the anamnesis, the Transsexual Voice Questionnaire (TVQ) (APPENDIX A) was used to collect data regarding her daily vocal activities, medication use, pre-existing diseases and expectations regarding treatment. In TVQ, the patient reported undergoing hormone treatment with the Perlutan injectable drug once a month.

In the speech-language evaluation, upper, mixed breathing, pneumophonoarticulatory incoordination, medium to deep pitch, adequate loudness, laryngopharyngeal resonance, median to slow speech speed, precise articulation and vocal quality with a slight pitch drop to deep were observed.

The patient was worked on vocal orientation and awareness, elevation of the fundamental frequency, phonation in smile and articulatory sharpness, exploration of different emissions and ascending modulation at the end of emissions, modification of the parameters of intonation, resonance, vocabulary, pronunciation, articulation and physiognomic and gestural expressiveness during speech.

Results

The Vocal Profile Analysis (VPA) Protocol aims to describe the most striking characteristics in vocal quality and vocal dynamics aspects, under the phonetic theory perspective [15].

The results of the auditory-perceptive evaluation occurred in two moments: before and after therapy.

What stands out is the prosodic aspects evaluated in the pre-therapy, namely: grade 1 refers to a small difference in relation to the neutral adjustment, grade 2 - slight difference in relation to the neutral adjustment and grade 3 - moderate difference in relation to the neutral adjustment [16].

In the pre-therapeutic moment, the patient presented little pitch variability with moderate grade, mild grade for high average setting, wide extension for both pitch and loudness and little loudness variability. The other settings are slight in relation to the neutral setting. The presence of high-grade tension was observed compared with relaxation.

In the post-therapeutic period, the crackling voice is no longer perceived. As for the prosodic traits, there were moderate settings in high pitch average, wide pitch and loudness extension and an improvement in variability.

There was a decrease in tension, the patient presented a more relaxed voice, in addition to a better division in the articulatory features.

Chart 1: Auditory-perceptive analysis of vocal dynamics - Before and After Treatment, respectively:

II- PROSODIC TRAITS										
CATEGORY	**FIRST ANALYSIS**			**SECOND ANALYSIS**						
	NEUTRAL	**NON-NEUTRAL**		**SETTING**	**NORMAL**			**ABNORMAL**		
		Normal	**Abnormal**		**1**	**2**	**3**	**1**	**2**	**3**
1. PITCH	X	X		High Average		X				
				Low Average	X					
				Wide Extension		X				
				Reduced Extension	X					
				Great Variability	X					
				Low Variability			X			
2.CONSISTENCY				Tremor						
				High Average	X					
3. LOUDNESS				Low Average	X					
				Wide Extension		X				
				Reduced Extension		X				
				Great Variability	X					
				Low Variability		X				

Acoustic Analysis

II- PROSODIC TRAITS										
CATEGORY	**FIRST ANALYSIS**			**SECOND ANALYSIS**						
	NEUTRAL	**NON-NEUTRAL**		**SETTING**	**NORMAL**			**ABNORMAL**		
		Normal	**Abnormal**		**1**	**2**	**3**	**1**	**2**	**3**
1. PITCH	X	X		High Average			X			
				Low Average		X				
				Wide Extension			X			
				Reduced Extension		X				
				Great Variability			X			
				Low Variability	X					
2.CONSISTENCY				Tremor						
				High Average		X				
3. LOUDNESS				Low Average		X				
				Wide Extension			X			
				Reduced Extension		X				
				Great Variability		X				
				Low Variability	X					

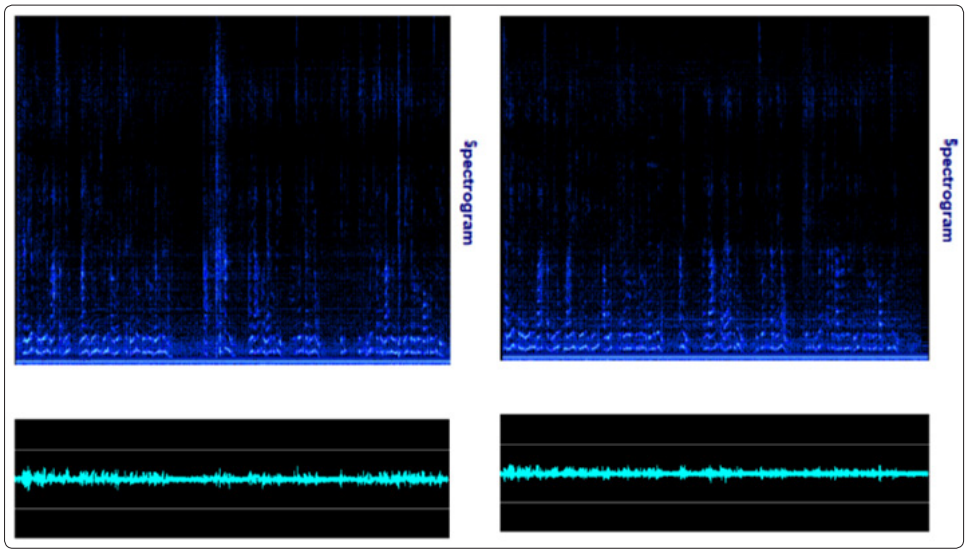

Figure 2: Visualization of spectrographic records in the Pre and Post therapy moments, respectively:

We have the spectrographic layout. What stands out is the amount of acoustic turbulence in the first figure, this term is linked to the accumulation of secretion, the harmonics become tangled and the predominance of basal frequencies [17].

There are differences, although small, between one tracing and another. In the second file, there is a better balance of sound energies. Possibly there was an adjustment and the recruitment of the thyroetenoid (TE) muscle decreased, with a participation of the cricothyroid (CT) muscle more present.

STATISTICS (from 0.00s to 24.12 s)	
Mode F0: 212.96 Hz	
Mean F0: 217.22 Hz	Mean Intensity: 60.89 dB
Minimum F0: 161.87 Hz	Minimal Intensity: 55.05 dB
Maximum F0: 364.55 Hz	Maximal Intensity: 71.08 dB
Stand. Deviation F0: 28.22 Hz	Stand. Dev. Intensity: 3.92 dB
Time with Voice Percentage:	47.05%
Voiceless Time Percentage:	52.95%
Sound Time Percentage:	100.00%
Silence Time Percentage:	0.00%
F0 Variability: 202.68 Hz	14 semitones

STATISTICS (from 0.00s to 24.12 s)	
Mode F0: 209.49 Hz	
Mean F0: 215.37 Hz	Mean Intensity: 59.58 dB
Minimum F0: 165.61 Hz	Minimal Intensity: 55.27 dB
Maximum F0: 382.92 Hz	Maximal Intensity: 68.64 dB
Stand. Deviation F0: 28.41 Hz	Stand. Dev. Intensity: 3.09 dB
Time with Voice Percentage:	47.05%
Voiceless Time Percentage:	52.95%
Sound Time Percentage:	100.00%
Silence Time Percentage:	0.00%
F0 Variability: 217.31 Hz	15 semitones

Figure 3: Visualization of numbers in the pre and post treatment files, respectively

The graphs demonstrate the main statistics of the voice. What drew our attention is the amount of semitones. states that a full voice requires 20 semitones in chained speech [17].

We have a slight increase in semitones in Figure 2, although it remains below the literature. At the same time, the f0 difference increased, the fundamental frequency variability improved and the intensity decreased. What can be seen is that there was a change, although discrete, between the first and second samplings. Possibly the person promoted less effort and obtained better vocal fluidity.

Discussion

The scope of this work reflects an analysis of the variation of vocal quality of a transgender woman at two distinct moments. We sought to analyze, through the auditory-perceptive and acoustic evaluation, the competence of exercise with high-strength tube associated with the therapeutic resource of low intensity laser in the elevation of the vocal pitch.

There was an improvement in variability in the pitch and loudness categories, absence of crackling after therapy. The patient used more thee breathing and there was a predominance in the distribution of articulatory adjustments, where the articulation of vowels was worked with the purpose of increasing the mandible opening so that the voice gained higher harmonics in the middle of the words, which provides a higher pitch to the voice, accentuation of the phonemes in a melodic way and increase at the end of the sentences to maintain the high pitch, always seeking the most feminine pattern, which is also possible to visualize in the spectrographic analysis (Figure 2) and in the comparison of statistical analysis (Figure 3f), complementing the result found in the auditory-perceptive analysis. The correlation between auditory and acoustic data is the basis of clinical, diagnostic and therapeutic reasoning of the speech therapist [17].

Language studies aimed at prosodia allow understanding new social and individual dimensions, through the application of various methods to investigate the auditory-perceptive aspects that help understand the adjustments of the vocal and phonatory tract of a subject during communication [16].

What makes the patient seek the treatment of vocal confirmation is the way the other perceives his/her voice, that is, the perceptive nature of vocal quality. Observing these resources used in the settings of this speaker, it is also noticed that, with this change in the voice quality and dynamics, there is a new construction of identity, whose supraglottis vocal setting was worked, promoting a new standard of vocal quality for this subject [1].

Thus, to raise the fundamental frequency, it is necessary to make the vocal folds vibrate more times per second. Thinking about the biomodulatory effect provided by low intensity laser, this effect causes a movement of muscle fibers and the associated use of the rigid tube increases vocal flexibility, activating and lengthening the cricothyroid muscle, which is responsible for producing the high pitch, providing a sensation of vocal fullness [1,17].

Exercise with a high-strength tube has shown positive results in the short term, both for vocal improvement and in the treatment and prevention of dysphonia. It is understood that partial occlusion of the lips leads to an increased impedance of airflow in the anterior part of the oral cavity, resulting in a sensation of vibration in the filter (resonance) and an increased intraoral pressure, being the air stream directed to the straw, thus being performed as a sound [18].

The human being has unique characteristics that contribute to vocal production. The voice is an individual marker and should be worked in a way that offers the patient comfort with the expression of gender in social interactions. When a characteristic is not in conformity with the desired gender, it can alter self-esteem, impacting social relationships and impairing their confidence to communicate, generating feelings of inadequacy and frustration [19].

Transgender people are not yet fully recognized by the state, often finding barriers that prevent them from competing in the labor market. One of the reasons that hinder their insertion is still discrimination at work and the different name in the identification document. This observation seems to justify some findings, if this subject makes use of his/her social name and has a voice and body that are in accordance with the desired gender, certain questions would be smaller or even not present [20].

Promoting the social inclusion of this population and inserting them in the labor market is part of the humanized treatment that we perform with this audience [4,21,22].

Conclusion

The speech therapy performed with the association of low intensity laser with exercise with high-strength tube promoted an increase of the vocal pitch, modifying the characteristics of vocal quality and dynamics, generating a sound fluency for the female. It was possible to observe that the greatest change occurred in a perceptual auditory way, interfering in the acoustic impression that the other has in relation to this voice, that is, the greatest gain was in the sound filter.

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