

## The Importance of Orofacial Motricity in the Work of Confirmation of Transgender Voice: An Integrative Review

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### ABSTRACT

The voice is a manifestation of the muscular process, but with psychological basis, thus being an important aspect in performance and gender recognition. The transgender person finds him/herself in biological bodies not recognized by him/her. Many of them undergo hormone treatments and surgeries to suit their gender identity and value interventions in their body and voice.

**Objective:** To explain the importance of the relationship between orofacial motricity and voice in the phonotherapeutic work to confirm the transgender voice.

**Methods:** A literature search was conducted covering the period from 2010 to 2020, including articles with experimental validation, which discussed therapy techniques or evaluation instruments.

**Results:** The search resulted in 1512 publications. After applying the inclusion and exclusion criteria, 31 articles were selected. After detailed analysis of the selected abstracts and prioritization of the discussion of orofacial motricity elements, nine articles were chosen for critical analysis. All selected articles contributed to clarify the research question.

**Conclusion:** Orofacial motricity plays a fundamental role in the confirmation of the transgender voice.

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### Introduction

Society attributes gender to a person through characteristics perceived in social interactions, which are usually visual clues (such as facial hair) or implicit rules of behavior and image (such as clothing) or hearing, such as voice [1].

For the transgender, the voice can “betray” the visual presentation, or become an obstacle to social acceptance, with the understanding that the better this voice is adapted to gender identity, the better the quality of life of the individual. Both sexes have resonance patterns, speed, intensity, pitch, loudness among other characteristics that differ them [2].

The transgender individual is the one who is born with male biological sex but has the mental perception of the opposite sex and vice versa, which happens because the sexual differentiation of the individual occurs in pregnancy, starting with the sexual organs, and then by the brain. In boys, testosterone concentration peaks between half of the second month until the end of the third month of gestation, causing the development of male sexual organs; in girls, the absence of this testosterone peak results in female sexual organs. On the other hand, the differentiation of the brain between male and female lines occurs only in the second half of pregnancy,

where a new peak of testosterone masculinizes the fetus’s brain or the absence of this peak results in a female brain. At this point, gender identity and sexual orientation are programmed into each individual’s brain for the rest of their lives. However, as genitalia is formed before the brain’s sexual differentiation, these two processes can be independently influenced by several factors (e.g., genetic factors or endocrine disrupting substances), which can generate people with male sexual organs but with female gender identity (female transgender or transgender women) or vice versa (male transgender or transgender men). This condition is called gender dysphoria, with no evidence that postnatal social factors play an essential role in the development of gender identity or sexual orientation [3].

The voice is linked to the individual’s identity, being a unique representation of each organism, thus leading to reactions according to physiological and psychological anatomical characteristics in a unique way, which makes the voice “sui generis” identifier. The voice, therefore, is not only a producer of speech, but is also the means of manifesting information, through language and linguistics as prosody, emotional expressiveness and self-identification. The voices are malleable and can be modulated by the individual according to his/her surrounding context [4].

It is a complex balance between multiple systems, requiring extensive extrinsic and intrinsic muscle work of the larynx and

oral adjustments. The physiology of the voice usually results from an expiratory flow or stream of air coming out of the lungs, causing the vocal folds to vibrate, while this air undergoes several modulations or supraglottic adjustments, which is necessary for the production of speech/singing [5].

The phonatory apparatus is an adaptation formed from the digestive and respiratory appliances. It encompasses the pharynx, mouth, nose, paranasal sinus, oropharynx, supraglottic region, palatine veil, tongue, larynx, lungs and muscles involved. The vocal tract is the region that modulates the voice coming from the vocal folds, being the sound filter, regions of resonance of the voice, a natural reverberator of the human body, being the supraglottic adjustments [6].

The supraglottic adjustments in the emission configure the formants that refer to the acoustic sound theory of speech production or source-filter theory, which consists in understanding the articulatory and acoustic aspects of speech [7].

This theory explains that the speech production system is divided into two primary components: a sound source that is produced by the larynx that provides acoustic energy to the system and supraglottic filters (vocal tract) that modify the system [8].

The sound of the glottic source is generated by the vocal folds when they vibrate and mold the pulmonary airflow into a sequence of air pulses. The acoustic characteristics of the glottic source refer to the fundamental frequency, its amplitude and the composition of its frequency spectrum [9].

The frequency of an emission depends on the length of the vocal fold, its tension and the mass placed in vibration while the intensity is a consequence of glottic resistance and finally, the vocal quality derives from the modifications made throughout the vocal tract. The fundamental frequency of the voice, F0, is the smallest periodic component resulting from the vibration of the vocal folds, being the first frequency produced by the glottis, stressing that the voice in adulthood is the one that presents after the end of vocal changes in boys, that is, after 18 years of age. From this period on, the voice is considered stable and is quite different according to the sex of the speaker, the average fundamental frequency for adult men (mean of 18 to 45 years) is lower, going from 113Hz and 204Hz, and for adult women is higher, being 231Hz [10].

The resonance of the voice is favored by mouth opening, lip and tongue movement, palatine veil, pharynx walls and larynx position, acting as a filter, with the movements of the vocal tract structures, adjustments are made in a short or long way. Each individual will use muscle adjustments specific to the need or way of speaking and/or singing [11].

The production of speech sounds requires an energy source, vibrating elements and filters, excessive use of the larynx or pharynx brings us a tense emission, excessive use of the oral cavity brings us overarticulation, with an excessively affected voice, excessive or insufficient use of the nasal cavity brings us a hypernasal or hyponasal voice [12].

Phonetic identity is formed by the first three formants, which provide phonetic consonance to the vowel, particularly the first two F1, F2. The tongue moves vertically according to the variation its height and jaw opening for the formation of f1. The second formant (f2) is related to the displacement of the tongue horizontally, in the anteroposterior direction. The third formant (f3) is related to the position of the tongue, a cavity that arises from the constriction of the tongue both before and behind. The fourth formant (f4) is directly related to the shape of the larynx and pharynx at the same height [7].

The aim of this review is to explain the importance of the relationship between orofacial motricity and voice in the speech therapy work to confirm the transgender voice.

## Methods

This study consists of an integrative review of descriptive and exploratory nature. The work began in the definition of themes of interest (orofacial motricity; confirmation of the transgender voice) and followed with the formulation of the research question: How to explain the relationship between orofacial motricity and voice in the phonotherapeutic work to confirm the voice of the transgender individual?

The languages chosen for the research were: Portuguese and English. To perform the search, the descriptors were delimited in the lists Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH), following both previously defined languages: *voz*; *voice*; *fala*; *speech*; *disforia de gênero*; *gender dysphoria*; *peessoas transgênero*; *transgender persons*.

The search bases chosen for consultation were: PubMed, Journal of Voice and CAPES Journal Portal, which includes relevant databases such as SciELO, BIREME, BioMed, LILACS and DOAJ. The criteria for choosing such bases were: the number of impact journals represented the relationship with the research theme.

The search was carried out between December 2019 and February 2020, with the crossing of the selected descriptors. The following search filters were used: only peer-reviewed articles; publications from 2010 onwards, which resulted in 1512 publications. By exclusion criteria, articles without abstract or full text and repeated articles were removed. As inclusion criteria, publications whose titles were related to the theme, articles with some type of experimental validation, articles discussing therapy techniques or instruments for evaluating therapeutic results. This selection resulted in 31 publications.

A second inclusion check consisted of analyzing in more detail the selected abstracts, prioritizing articles where there was also discussion of orofacial motricity elements. Publications between 2016 and 2020 were prioritized, but a 2013 publication was included due to the great adherence to the aforementioned inclusion criteria (see Table 1). Thus, nine articles were selected for critical reading. These articles and their main features are listed in Table 1.

**Table 1: Studies selected and critically analyzed**

Study	Authors	Year	Country	Main Theme	Sample	Results and Highlights
Vocal congruence: the voice and the self measured by interoceptive awareness	Crow KM, Mersbergen MV, Payne AE	2019	USA	Vocal congruence	50	<ul style="list-style-type: none"> <li>- Recognized the voice as a marker of the individual's identity;</li> <li>- Established the term "vocal congruence" for the alignment between the voice and the identification of the individual;</li> <li>- Proposed and tested a scale for measuring vocal congruence;</li> <li>- Concluded that the perceived vocal congruence is more accurate when there is more inner body awareness;</li> <li>- Concluded that vocal congruence reflects a positive self-image.</li> </ul>
Crossing gender borders: bidirectional dynamic interaction between face-based and voice-based gender categorization	Huestegge SM, Raettig T	2018	Germany	Vocal congruence	24	<ul style="list-style-type: none"> <li>- Investigated the interaction between facial and vocal processing in the gender categorization;</li> <li>- Created a model of dynamic interference between face and voice, with cases of congruence and incongruence between both;</li> <li>- Conducted tests with this model under different conditions;</li> <li>- Observed that facial and vocal recognition interfere in each other to determine gender and that there is a strong integration between the visual and auditory information channels;</li> <li>- Concluded that we used the face and voice of the interlocutor to determine the gender as a whole, not in isolation.</li> </ul>
Masculine voices predict well-being in female-to-male transgender individuals	Watt SO, Tskhay KO, Rule NO	2017	Canada	Vocal congruence	77	<ul style="list-style-type: none"> <li>- Confirmed the voice as an important marker of individual identity and gender;</li> <li>- Focused on the study of male transgender, to which little literature was dedicated;</li> <li>- Associated a transgender voice assessment protocol with protocols of various dimensions of psychological well-being;</li> <li>- Concluded that trans men achieved greater well-being when vocal congruence with gender was greater;</li> <li>- Demonstrated by experiment that the well-being resulting from vocal congruence brings reflexes far beyond simple satisfaction with the voice;</li> <li>- Stressed that for many trans men, masculinization of the voice is one of the most important goals of gender alignment.</li> </ul>
Toward a protocol for transmasculine voice: a service evaluation of the voice and communication therapy group program, including long-term follow-up for trans men at the London Gender Identity Clinic	Mills M, Stoneham G, Davies S	2019	England	Vocal therapy for male transgender	10	<ul style="list-style-type: none"> <li>- Included additional dimensions in male transgender vocal therapy in addition to pitch reduction, such as communication skills;</li> <li>- Conducted and evaluated a group therapy with subsequent follow-up;</li> <li>- Achieved an effective therapy even for individuals who were not treated with testosterone;</li> <li>- Obtained an increase in the sensation of masculinity and comfort of the voice that remained in the monitoring phase;</li> <li>- Reinforced the need for a protocol to modify the voice of the male transgender.</li> </ul>

Voice challenge in transgender women: trans women self-perception of voice handicap as compared to gender perception of naïve listeners	Schmidt JG, Goulart BNG, Dorfman MEKY, Kuhl G, Paniagua LM	2018	Brazil	Evaluation of vocal perception of female transgender	31	<ul style="list-style-type: none"> <li>- Recognized the importance of self-perceived voice of female transgender people, as well as of the perception by lay listeners for the success of the gender transition;</li> <li>- Observed that patients who perceived their voices as feminine and satisfactory had greater identification as feminine by lay listeners;</li> <li>- Reinforced that the fundamental frequency alone was not a determinant for the trans woman to consider her female voice;</li> <li>- Identified that emotional issues affect patients' vocal perception more than physical and functional issues.</li> </ul>
Gender perception after raising vowel fundamental and formant frequencies: considerations for oral resonance research	Gallena SJK, Stickels B, Stickels E	2017	USA	Influence of formants on vocal gender perception	111	<ul style="list-style-type: none"> <li>- Remembered that speech reveals clues about the speaker's gender and that anatomical differences influence speech frequencies, but that there is little research to support the techniques of voice and speech treatment;</li> <li>- Pointed out that listeners perceive inconsistencies between the different frequencies of the vocal signal;</li> <li>- Concluded that changes in formants alter the perceived gender by listeners.</li> </ul>
Effect of phonation on perception of femininity/masculinity in transgender and cisgender speakers	Houle N, Levi SV	2019	USA	Influence of formants on vocal gender perception	20	<ul style="list-style-type: none"> <li>- Recalled that listeners use information both from fundamental frequency and from formants to identify the speaker's gender in the absence of visual information;</li> <li>- Used whispered speech to reduce the effect of fundamental frequency and evaluate the effect of formants;</li> <li>- Detected the listeners' difficulty in perceiving gender in whispered speech in relation to normal speech;</li> <li>- Concluded that previous vowels were considered more feminine.</li> </ul>
Case report of speech-language therapy work for voice adequacy of a male transgender	Lopes JC, Silva KA, Vieira R, Marques VS, Ferreira LP, Andrada e Silva MA, et al.	2019	Brazil	Vocal therapy for male transgender	1	<ul style="list-style-type: none"> <li>- Recognizes speech therapy as important to improve vocal tract awareness;</li> <li>- The work with the patient encompassed multiple aspects, including resonance;</li> <li>- The auditory-perceptual analysis showed a significant difference in the vocal quality standards.</li> </ul>
Perceptual and acoustic outcomes of voice therapy for male-to-female transgender individuals immediately after therapy and 15 months later	Gelfer MP, Tice RM	2013	USA	Vocal therapy for male transgender	5	<ul style="list-style-type: none"> <li>- Recognized that the voice differs between genders in several parameters;</li> <li>- Compared the results before, after therapy and 15 months later;</li> <li>- Concluded that the voice of treated transgender women showed improvements in the various parameters measured and, even with some loss 15 months after therapy, the voice was still better than before the therapy;</li> <li>- Realized that the results vary a lot in each individual.</li> </ul>

After reading and critical analysis, all articles presented the desired quality, as they brought contributions to answer the research question and discussed therapies and validation instruments with experimental evidence.

### Literature Review

Of the nine texts analyzed, all addressed voice as a gender marker, anatomical differences between men and women [2,4,13-19]. One of these studies<sup>13</sup> confirmed that vocal and facial information is processed together to identify the person and gender as a whole, which reinforces the need for the transgender person to adapt the voice with the visually manifested gender to improve communication and the perception of gender authenticity. In a little

more detail, it was demonstrated that during social interactions, vocal and visual clues interact in the perceived gender, which gives so much importance to the voice as a marker of gender and identity, to the point that, for example, a survey of male transgender people revealed that 88% considered voice masculinization as important as or more important than sexual reassignment surgery, and 30% expressed interest in speech therapy even after testosterone treatment [14]. It is necessary to highlight that one of the studies reinforces that speech therapy is very important for the vocal confirmation of transgender, especially to improve awareness of the vocal tract [18].

Regarding the implications of anatomy, two articles are strongly in line as they support that gender differences are a reflection of



anatomical differences [16,17]. The length and mass of the vocal folds (which determine the fundamental frequency, or pitch) and the length and size of the vocal tract (which determines the resonant frequencies of the formants, or overtones) stand out.

In relation to vocal modifications, four texts agree that resonance makes all the difference for the recognition of a more feminine voice. One of these texts points out that resonance-based therapy has had significant success, even over one year after therapy [2,16,17,19].

One of the studies showed that the fundamental frequency alone is not enough for the listener to consider a female voice, because F0 does not influence the specific inflections of each gender [2]. Thus, even the transgender woman does not consider her own voice appropriate to her gender only by modifying the fundamental frequency.

Moving in the complementary direction, two studies with transgender women highlighted the role of resonant frequencies, noting that some vowels are perceived as more feminine, such as the vowel /a/, for example [16,17]. Similarly, the results of another study showed that after resonance-based therapy (and even over a year later), listeners classified all voices as less masculine and more feminine, with increases in the vowel-formative frequencies of all transgender women in the test [19].

Regarding prosody, two texts pointed it as a differential in voice confirmation [15,18]. Following the therapy model explained in one of the articles, prosody is one of several dimensions that should be addressed in the vocal confirmation of transgender. The same work considers male transgender therapy extremely important for self-esteem and states that good results were obtained in the work with the patient, which involves orientation and social awareness, exploration of emission, gesture and prosody. When evaluating this therapy model, auditory-perceptual analysis showed a significant difference in vocal quality standards before and after vocal therapy [18].

All texts state that the voice plays an important role in social life, as it brings physical and sound congruence [2,4,13-19]. According to one of the texts, this physical and sound symmetry produces well-being for transgender people and empirically demonstrated that well-being occurs in multiple dimensions and goes beyond simple satisfaction with the voice [14].

In this sense, as one of the studies points out, besides being a means of expressing language, the voice also transmits paralinguistic information, such as prosody, emotional expressiveness, age, gender and health status [4]. Since it is malleable, the voice can be actively modulated depending on the mood, social context, environment and characteristics of the interlocutor. The authors discuss that vocal congruence represents how much the voice is aligned with the identity of the speaker, which is a sensitive point for transgender individuals. However, as they highlight well, there is a lack of specific tools to assess the degree of vocal congruence of an individual [4].

A study evaluating patients soon after therapy and, again, over a year later pointed out good results obtained with eight-week therapy and demonstrated that the effects were long-term, but vary from one individual to another [19].

All texts emphasize that resonance is the determinant for the patient's good performance and that transgender people need therapy so that they can confirm vocal identity [2,4,13-19]. In

this sense, one of the studies with an experiment conducted with transgender women points out that a therapy focused on oral resonance could improve the perception of listeners regarding the femininity of the voice [19]. In agreement with this point, another clinical experiment conducted with transgender men achieved full-bodied voice resulting from the combination of several exercises for resonance modification [15]. The authors of this article discuss and demonstrate that the reduction of fundamental frequency alone does not satisfy a complete gender identity, and interventions are also needed in vocal dynamics (pitch, resonance, loudness, intonation and vocal quality) and in social communication skills in order to achieve good results [15].

Finally, a study based on changes in resonance stated that there is still a need for more researches and evidence to support speech and voice therapies for transgender people [16].

### Conclusion

Orofacial Motricity is the area of speech therapy responsible for maintaining or restoring oral functions, thus playing a fundamental role in the confirmation of the transgender voice, since therapy focuses on resonance and speech.

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