



Voice Fundamentals & Effects of Hormone Replacement Therapy

From the Vocal Congruence Project - vocalcongruence.org/#voice-hrt

Overview of Voice Production

Respiration

Our voice begins with our breath. We contract our diaphragm and other muscles of inspiration to bring air into the lungs. As we relax our diaphragm, we exhale air, which passes up through the airway and vocal folds.

Phonation

The vocal folds are two side-by-side muscles that remain open in a V shape when we breathe, close when we swallow, and come together to vibrate when we speak and sing. This vibration is called “phonation.”

The pitch (how high or low our voices sound) is determined by the thickness, length, and tightness of the vocal folds. The resting length and thickness of our vocal folds increase during puberty. Testosterone-driven puberty experienced by people Assigned Male at Birth (AMAB) increases the mass and length of the vocal folds significantly. This structural change results in a large decrease in pitch. Those Assigned Female at Birth (AFAB) also experience a decrease in pitch during puberty, although it is much smaller.

Following puberty, the size and length of the vocal folds generally do not change substantially. However, some people experience voice changes later in life. AMAB people may develop a higher pitch and other changes in voice quality due to age-related muscle atrophy, changes in breath support, and more. Some AFAB people develop a lower pitch due to hormonal shifts during menopause.

When speaking and singing, pitch is actively controlled by the cricothyroid muscle, which adjusts the tightness of our vocal folds. Other small muscles in the voicebox also help to “tune” and control the sound. As an analogy for the effects of size, length, and tightness on sound production, imagine an acoustic guitar. The thickest string produces the lowest pitch, while the thinnest string produces the highest pitch. When a finger is placed on a string to shorten it, the sound gets higher in pitch. Additionally, when the guitar is tuned, a knob is turned to wind or

release the string, increasing or decreasing tension. When wound tighter, the pitch is increased, and vice versa. The vocal folds also change pitch as their tension changes.

Another quality determined by how we use the vocal folds is called vocal weight. This is the perceived "lightness" or "heaviness" of a voice. A lighter voice is typically perceived as more feminine, and a heavier voice is typically perceived as more masculine. This change in sound quality is based on the thickness of the vocal folds, as well as how much they press together when making sound.

Resonance

Sound generated at the vocal folds is shaped by our throat, mouth, and nose on its way out of our mouths. Resonant quality (how bright or dark our voices sound) is determined by the size, shape, and material of these spaces. A larger resonating space results in a darker sound, typically perceived as more masculine. A smaller resonating space creates a brighter sound, typically perceived as more feminine.

All resonating chambers will grow alongside our bodies as we develop and age. Changes in resonant quality accompany changes in pitch during puberty, resulting in our adult voices. AMAB people typically develop larger resonating chambers.

When speaking and singing, we actively adjust the size and shape of our resonating chambers using a variety of muscles. For example, count to five with your mouth first in a more "eeee" position, like you're smiling, and then in more of a "oooo" position. The difference in sound is created by adjusting resonance through tongue placement and lip shape.

To put these concepts together, return again to the image of an acoustic guitar. The resonating chamber is the body of the guitar. Now imagine the difference in sound made by a ukulele. The smaller body and shorter strings results in a higher, brighter sound.

Articulation, Language, and More

Finally, we use our tongues, lips, teeth, and more to form sound into speech. All of these elements and more work together to inform how others perceive our voice. While pitch and resonance are generally considered the most important, other notable features can include volume, inflection, nonverbals, and more.

Anatomical Effects of Hormone Replacement Therapy (HRT)

Feminizing HRT

Feminizing HRT refers to the use of exogenous (not produced in the body) estrogen and/or an antiandrogen (e.g., spironolactone). Feminizing HRT has no effect on the structures underlying voice production. The increase in length and mass of the vocal folds and size of the resonating chambers caused by testosterone-driven puberty in AMAB people is permanent. [Surgical approaches](#) are the only way to modify the vocal anatomy.

However, our control over the many muscles of speech production allow us to modify the pitch, resonance, and other features of voice and communication. Vocal feminization is possible through training and practice.

Masculinizing HRT

Masculinizing HRT refers to the use of exogenous testosterone. Testosterone can cause changes to the vocal folds at any age. These changes primarily include thickening the vocal folds, resulting in a permanent reduction in pitch and increase in vocal weight.

The effect of post-pubertal exogenous testosterone on the length of the vocal folds is poorly understood. As we age, cartilages including our larynx, or voice box, become less flexible. Thus, HRT may have lesser effects on vocal fold length, especially when started at later ages. For similar reasons, significant changes in resonance are unlikely to be seen from HRT alone.

Changes depend on many factors, including baseline pitch, method of administration, dosage, and more. The first changes to the voice may occur as early as a few weeks on testosterone. Deepening of the voice to a cismasculine range is expected in approximately 1 year. However, research indicates that 21% of people may not reach a cismasculine pitch range, and 16% were unsatisfied with their voices after these changes had plateaued (Ziegler et al., 2018). Further change to pitch and resonance can be achieved through practice and training.

A slower rate of change may be desirable for some, including singers and those who have not yet socially transitioned. Individuals seeking slower voice changes may opt for a lower HRT dose to facilitate this, however, it is not possible to predict the exact ways an individual's voice will respond at any dose.

Socially Influenced Vocal Characteristics

No aspects of voice are purely a product of the underlying anatomy. Rather, voice is a product of the conscious and unconscious ways that we use that anatomy.

Significant evidence reveals that gendered aspects of voice have a socially learned component. For example, the vocal tracts of children are largely identical prior to changes occurring during puberty, yet listeners can tell the gender of boys and girls by voice alone. Various languages and cultures show wide differences in many vocal characteristics. Finally, aspects of identity with no associated anatomical differences (e.g., sexual orientation, socioeconomic status) influence the voice. These voice changes are largely unconscious.

Consider also how your voice changes across situations and settings. Does your voice sound the same when talking to a child as it does an adult? How about a colleague versus a best friend? Or when you are excited versus sad? A wide range of vocal expression is possible regardless of anatomy.

Effects of Identity, Transition, and HRT on Socially Influenced Vocal Characteristics

For transgender and gender diverse people, there is little known about how these socially influenced features develop or how they change with transition. One study found children ages 5-13, assigned male at birth and diagnosed with gender identity disorder (GID, a now-outdated term referring to gender dysphoria) sounded less masculine to listeners than same age boys without a diagnosis of GID (Munson et al., 2015). This indicates that those with an awareness of gender dysphoria in childhood develop socially influenced vocal characteristics differently.

The gender exploration process accompanying transition, as well as emotional effects of HRT, may work to deconstruct internalized social norms that influence voice. For example, a transfeminine person may no longer feel pressured to “perform” masculinity, resulting in an unconscious shift in speaking voice. Some trans women say that their ability to access an “emotional self” increased with feminizing HRT, making it easier for them to access ways of talking that are more expressive and aligned with classic notions of femininity.

Another study found that the speaking pitch of some transgender men on HRT lowered as expected, but then increased. As the changes caused by testosterone are irreversible, this indicates a “conscious or unconscious fine-tuning” to better align voice and identity (Papp, 2011). Some trans men also report purposefully trying to effect a “nice” way of speaking—this typically involves one or more voice and speech changes that are aligned with more feminine voice—so that it is clear to listeners that they can be trusted and are safe.

Conclusion

The sound of each person's voice is uniquely formed through both their vocal anatomy and how they use that anatomy, the latter being informed by identity and other social influences. There is no singular way to sound masculine, feminine, androgynous, etc. Expanding vocal expression

can be a physical and emotional process, influenced by HRT and social transition. To learn more about this topic, we suggest reading our resource "Exploring Your Voice Goals":
vocalcongruence.org/#goals