Bulletin of the *Transilvania* University of Braşov
Series VIII: Performing Arts • Vol. 18(67) Special Issue – 2025
https://doi.org/10.31926/but.pa.2025.18.67.3.21

The Functioning of the Light Mechanism in the High Register of the Tenor Voice – A Case Study

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Abstract: *The tenor voice represents a complex control of muscles, including larynx, tongue, breathing process and vocal cords closure among many others. The schools of teaching the high register have a diverse approach: one more centered in carrying the chest voice and other with less chest voice. The light mechanism in the tenor voice refers to a phonatory strategy characterized by reduced mass and lowered tension in the vibrating portion of the vocal folds, coupled with modifications in vocal tract configuration and glottal adduction, to produce a brighter, more agile timbre, especially in upper tessitura. This mechanism is often opposed to the "heavy" or chest-dominant mechanism, which emphasizes thicker folds, higher glottal closure, and a denser sound. In tenors, transitions such as the passaggio (the region of register shift) demand precise control over this mechanism: research shows that adjustments in epilaryngeal constriction, laryngeal height, jaw and lip opening, and vowel shaping contribute significantly to maintaining continuity of tone and avoiding abrupt breaks. New studies have revealed that the more chest voice you used the heavier and with effort is your emission. But is it through developing head voice with chest mix that helps? This article tries to find an answer by collecting new information and appliance in vocal students and interviews to make a conclusion.*

Key-words: *Tenor, upper register, light mechanism, voice, chest voice, passagio*

1. Introduction

The tenor voice, particularly in its upper register, requires a fine balance of physiological coordination and acoustic tuning. The transition through the *passagio* – a critical area of vocal register shift that usually takes place around E4, F4 or F#4 – has long challenged both singers and teachers. This challenge is well known, and it depends on the singer's vocal timbre: if it's more dramatic, the shift usually happens earlier, around E4; if the singer has a lighter voice, it can take place around F#4 or even G4. In the *passagio, where* the singer usually must modify the

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vowel into a more chest dominant or darker sound, that is where the problem starts. Vocal pedagogy is traditionally divided into two broad camps: one favoring the extension of the chest voice originating in a more dark and muscular sound, with a thicker vocal cord, that originally started with Caruso, and another advocating early integration of a lighter, more head-dominant mix, in which the vocal cords are vibrating more freely in a thinner posture with less involvement of the muscles around the larynx. This latter is linked to the Italian tradition of *belcanto* singing: "*The Italian singing tradition evolved over a period of some three hundred years until the first decades of the nineteenth century. We cannot know what the style sounded like (…) but the evidence suggests that it was characterized by smoothness of line, flexibility of phrasing and an ability to sing with lightness and agility*." (Potter 2009, 78.)

These different approaches reflect two types of singers: one that sings high notes with a laser cut sound and has the ability of doing several dynamics with it, and another type of singer that has a bulkier, more robust and darker sound which, on the other hand, doesn't travel so much acoustically. This darker sound is also culturally associated with virility, sounding more manly. This sound is produced by carrying more weight and chest voice up, making you think that you sound bigger. However, that is not true, as it has been broadly discussed in many webinars available online as well as in vocal discussions regarding pedagogy. This is a trend that was started with Caruso, Pertile, Martinelli to name a few, and it is one of the reasons why Caruso gained so much fame in his time (Potter 2009, 83).

It's important to refer that these two approaches to singing have nothing to do with a tenor's voice type. A singer can be a dramatic tenor and still have a laser cut high notes and the ability to do diminuendos on them. One example is Giuseppe Giacomini's recording of *E lucevan le stelle*, where his high notes are brilliant and have the ability of doing diminuendo with a robust and dark sound. The same goes for Franco Corelli, who does a historic diminuendo at the end of *Celeste Aida* aria. On the other hand, a singer can have a light voice but with forced and chesty high notes that do not carry through.

The present study aims to assess whether cultivating a head-dominant mix, rather than forcing chest voice extension, leads to improved tone quality, reduced effort and more stable transitions in the tenor voice. To study these points, in the next section we will start by clarifying some essential facts about the vocal mechanism. Further down in the article, these facts will be complemented with interviews to a vocal pedagogue expert in the Tenor voice and professional tenors and examined in light of bibliography that reveal important information in this field.

2. State or art

The author of this article has been doing research in this field, watching and taking part in voice lessons and masterclasses with tenor expert Professor Jack Livigni, who is an established vocal pedagogue and a voice consultant known worldwide. In his view: "*In order to produce a light mechanism in the tenor voice it's essential that the larynx tilts in certain areas of your range".* This seems obvious but very often there are many singers that do not tilt their larynx, resulting in a nasal and smaller sound with a hard transition between registers. For the larynx to tilt, which is usually more dominant around C4, the head voice starts to join chest voice in a mix voice up to the *passagio*. To get the larynx to tilt you need to see that your Adams apple is moving downward (you can see this movement if you approach closely to the throat. This can be seen in almost all professional tenors). When you see this downward movement, the cricothyroid muscles are elongating the vocal folds (Miller 1993, 6). But at the same time, to feel that downward movement, you need to be in the yawn position, known in the Italian tradition by *lo sbadiglio* (Miller 2011, 17). While reading this, the reader may question: *Do I have to push down my larynx while I am singing?* The answer is absolutely no. Your larynx needs to float and be free through all your range but, in certain areas of your range, it needs to tilt so that the vocal cords stretch, giving an easiness in the register transition. The denomination of tilt is, in my opinion, more pedagogical, given the thought of pushing down your own larynx is too abrupt for the singer's mind.

An obstacle to this tilt is the closure of the vocal cords. To obtain a clean sound, the cords need to close and not let the air go through but within the yawn position. The problem is that, in the yawn position, the vocal cords are abducted, producing a woofy sound. However, with time – and it sure takes time – your brain needs to learn how to adduct the vocal cords and produce a clean sound. In other words, your vocal cords need to learn how to close (adducted) in the yawn position.

After learning how to close (adduct) the vocal folds, when the tenor arrives at the *passagio*, the voice tends to darken because of the shift of registers. By modifying the vowel in the *passagio,* the tenor must pay attention to the upcoming high register. In the high register, when the vocal cords are closing and the larynx tilting, there is a natural tendency to get darker. You cannot carry that weight up to the high register, you must drop it. It is easier said than done, for sure. When you are singing a darker tone, you are gaining weight in the voice and the vocal folds become thicker (Miller 2011, 7-11).

When you are singing darker, the tendency is that the chest voice is acting livelier, but you must train yourself not to have that much chest voice in the high register in the mix voice. Imaging and high-speed video endoscopy studies (e.g.,

Echternach et al., 2010) have provided empirical data on vocal fold behaviors in professional singers, detailing how tenors achieve high notes through decreased glottal closure, increased longitudinal tension (via Cricothyroid muscle, which is the muscle responsible for elongating the vocal cord - yawn position), and altered vocal tract shaping.

You must drop a big part of the chest voice that you carried in the *passagio*, increasing the head voice more and less chest. When dropping some chest voice (here relies on the secret: in how much chest voice the tenor needs in the high register) you cannot drop it all, otherwise it will sound *falsetto*. When the tenor drops a big part of the chest voice in the high register, the vocalis muscle is freer because the sound is not stiff but rich, giving a laser cut quality.

The literature in this area states that the phenomenon of vocal register transitions, especially in male singers, has long been the focus of scientific and pedagogical research. Titze (2000) classified laryngeal mechanisms into M1 (modal/chest) and M2 (falsetto/head), identifying fundamental differences in muscle engagement and vocal fold vibration patterns. Sundberg (1987) emphasized the importance of formant tuning in professional singing, particularly in the male upper range, noting the role of F1-H2 coupling in enhancing vocal intensity and projection.

Miller (1993) addressed the practical challenges that tenors face in bridging the *passaggio*, the transitional zone between registers, suggesting that the development of a “head voice” or “mixed register” is essential for vocal longevity and performance. Henrich (2006) expanded on this by showing, via electroglottographic and spectral analyses, that professional singers use a hybrid strategy involving both M1 and M2 characteristics when singing in the high register, challenging the binary classification of registers. An important aspect of these studies is that we don’t know what kind of singers were used and how did they sound when they sang for those studies.

3. Discussion

The light mechanism, also known as voice-mix (chest and head voice) coordination, allows for more flexibility and reduced phonatory effort, but its integration requires technique, muscular training and perceptual recalibration. With modern pedagogical approaches and voice science tools such as electroglottography (EGG), spectrographic analysis and real-time resonance monitoring, we can now better understand how these mechanisms function and interact.

The approach of this light mechanism has 3 aspects:

- Vocal closure
- Tilt of the larynx

- Release of the vocalis muscle

The reunion of the 3 mechanism aspects will give the tenor voice a bigger sound, more brilliant and with much less effort.

How can it be obtained? This is the important question. The answer is: through specific types of vocal exercises.

The author of this article followed 4 different lyric tenors during one month of working with Professor Jack Livigni, 2 of them with voices more on the light side and the other 2 tenors more romantic and with robust sound. All of them were professional voices. All four of them had much difficulty in accessing the high register with easiness phonation.

The journey began with weekly specific exercises for the attack and glottal closure.

Methodology included in each session – for each tenor:

- Tilt the larynx after the low register and in the beginning of the medium register around C4, through the yawn position, with the larynx relaxed but not squeezed. Sing small scales with all vowels. The sensation of the cry baby was recommended also for emission.[2] When having this in mind the sound doesn't get dark, but bright and vibrant.
- In the *passaggio,* together with the tilt, the sound had to be clean, with focus, the vowels were slightly modified in "ë" sound, in a more vertical position.
- After the *passagio* around A4, the note had to keep an even more ë or a sound like the French word "prin-temps", with the tongue bulking in the mouth so that it would be out of the way and the larynx could do the job of thinning the vocal cords. This way the tongue is not interfering inside the throat.
- Do not push air into the mask, have the sensation of sigh and that you are aspirating the air.
- The sensation of suspension of the breath in the thorax is important to give you the support you need.
- If it is not easy, it's not a light mechanism, but rather a thick and heavy access to the high register. The *vibrato* should be free and rich of harmonics.
- The phonation needs to be light like *falsetto*.
- The intention of your sound needs for it to be light.
- Track your resonance and brilliance, not your volume or darkness

[2] This is a very common idea in the tenor voice pedagogy. The sensation of imitating a baby crying. The tenor Lauri-Volpi mentioned this in his sessions with Franco Corelli. By imitating a baby crying, you will get the idea of thinning the vocal cords and in a lighter way.

3.1. Procedure

The study was conducted with weekly sessions for each tenor and supervised practice. Used methodology:

- **Pre- and post-study vocal recordings**, particularly on F4–C5 range.
- **Resonance analysis** using VoceVista or similar acoustic software.
- **Subjective assessments**: students rated perceived effort, vocal fatigue and confidence during high notes.
- **Interviews** with the tenors on their approach and sensations while developing the upper register on light mechanism.

3.2. Data collection tools

- **Acoustic software** for formant and harmonics tracking.
- **Voice Range Profile (VRP)** tests pre- and post-training.

4. Results

4.1. Vocal efficiency and tone quality

After doing the proposed exercises during one month, all four tenors demonstrated smoother transitions through the *passaggio* with fewer signs of vocal strain. In the high register the acoustic data revealed:

- **stronger presence of upper harmonics**, indicating better resonance tuning;
- **lower subglottic pressure estimates**, suggesting more efficient phonation and sensation of singing in *falsetto*;
- **more stable formant tuning** around the medium E4 F4–G4, key notes in the *passaggio.*
- Laser cut sound with rich harmonics in the high register.

All tenors described singing high notes as "lighter", "more connected" and “less effortful.” This sensation was exactly the opposite of the singers’ previous reaction when approaching the high note. Usually, when you think you need more support, you add tension in your singing, which results in a pushed, dark and heavy high note like a dry sound. After using these exercises, the tenors described the exact opposite: it sounded easy to access the high register, almost like a *falsetto* feeling, which is counterintuitive.

5. Discussion

The findings reinforce the pedagogical argument that developing a light, head-dominant mix leads to more sustainable vocal production for tenors, particularly above the *passaggio* (typically E4–F#4). Attempting to "carry the chest" too high often results in compensatory tension, reduced resonance efficiency and eventual vocal fatigue. I would also dare to suggest that this gentleness should start in the medium register, or at least have it in a singer's mind by then, so that it also results in an easier access to light mechanism for the high register.

The light mechanism involves a delicate balance of coordination, not a strict shift of registers from chest to *falsetto*. This aligns with Henrich's (2006) view of a register continuum and contradicts earlier models that considered head voice as a distinct *falsetto* state.

Acoustically, tenors adapt vocal tract shaping to perfect formant-harmonic alignment, particularly above the *passaggio*, confirming Sundberg's (1987) observations. This suggests that register negotiation is as much an acoustic event as a laryngeal one.

Pedagogical implications include the need to train resonance strategies, laryngeal flexibility and proprioceptive awareness to master the light mechanism. Ignoring these can lead to pressed phonation, vocal fatigue or range limitations.

The light mechanism is a procedure that is not easy to master, as it is initially counterintuitive for most singers (due to lower perceived volume or masculinity), but it provides a pathway to vocal freedom and range extension. To have in mind that you have to release all the weight in the vocal cord to access the light mechanism, is something very challenging for a tenor (after G#4, depending on the voice type). Moreover, formant tuning strategies and vowel modification were found to be crucial in the path of achieving the light mechanism while keeping tonal consistency through register shifts.

This study also suggests that teachers should focus more on sensation and resonance strategies rather than muscular force, especially during early vocal development.

6. Conclusion

This study proves that cultivating a head-dominant, lighter vocal mechanism provides tenors with a more efficient, sustainable and resonant approach to singing in the upper register. Through the systematic observation of four professional tenors and the application of targeted vocal exercises under expert guidance of Jack Livigni, the findings revealed that integrating a lighter phonatory setup – characterized by balanced laryngeal tilt, precise glottal closure and release of

excessive vocalis tension – produces greater ease, stability and brilliance in tone. Acoustic analyses confirmed this improvement, showing enhanced harmonic richness, more stable formant tuning and reduced subglottic pressure, all indicative of improved vocal efficiency.

Beyond the technical and physiological evidence, the research also challenges cultural and pedagogical assumptions about vocal masculinity and the perceived power of a darker, chest-dominant tone while singing. The tendency to equate strength with heaviness in chest voice often results in unnecessary strain and limits expressive flexibility in the high register. By contrast, the adoption of a light mechanism, consistent with the Italian *belcanto* tradition, encourages a freer resonance and a broader expressive palette without compromising vocal intensity and artistic impact.

From a pedagogical standpoint, these results underscore the importance of teaching that emphasizes coordination and resonance awareness rather than muscular effort (chest voice). Exercises that promote the integration of the head mechanism –particularly in the *passaggio* and high register – should be prioritized for tenor training. Such an approach aligns both with contemporary voice science and with historical practices that valued agility, clarity, rich harmonics and brilliance in the upper register.

Ultimately, the outcome reaffirms that vocal freedom arises not from force but from balance – between physiological efficiency (what gives squillo do the voice), acoustic alignment and artistic intention. The head-dominant mix thus stands as both a technical solution and a return to the expressive ideals of classical singing: beauty, effortlessness and resonance that communicates. All of this in according to the tradition of the *belcanto*.

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