

Article

Micro Cough without Cough: A Study on the Vocal Sound Training of Micro Fibrillation of Ngu

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Abstract: Micro-coughing, rather than a typical cough, is considered a perfected form of glottal impact. As one of the most significant acoustic theories in vocal music history, it was first introduced by Manuel García, a professional singer. However, due to improper singing techniques, he was forced to quit music at the age of 24. He then dedicated over half a century to research and first proposed the glottal impact theory in 1847. With the invention of the laryngoscope in 1855, the theory was further developed and officially established in 1894. This paper draws on more than 30 years of professional vocal teaching experience to examine the glottal impact theory. It focuses on key issues in muscle energy research, summarizes the main achievements and challenges in this field, and explores specialized research on micro-sound of Ngu aggregation and the expansion of vocal sound training methods. Suggestions and insights from experts are welcome.

Keywords: microcough; microfibrillation; ngu; vocal training mode

1. Introduction

With the continuous evolution of vocal art, the pursuit of vocal techniques has reached a more refined level. As an innovative vocal training method, this approach is designed to achieve subtle changes and enhance sound through specific muscle control techniques, which play a crucial role in improving the artistic and expressive power of vocal performance. This study aims to explore in-depth the theoretical foundation, practical application, and physiological mechanisms of this vocal practice method, with the goal of providing new perspectives and methodologies for vocal music teaching and practice.

2. Study Jects: Microfibrillation Ngu Sound Mode Without Cough

Micro-coughing, rather than a typical cough, is considered the perfected form of glottal impact. As one of the most important acoustic theories in the history of vocal music, its founder, Manuel García, was a professional singer. However, at the age of 24, due to improper singing techniques, he was forced to say goodbye to music and dedicated more than half a century to research. After 1847, and with the invention of the laryngoscope in 1855, the theory was eventually formally established in 1894. This study, based on over 30 years of professional vocal music teaching experience, focuses on the glottal impact theory, addressing major issues in functional research. Through progress in this area, it summarizes the main achievements and challenges, while also exploring the micro-Ngu aggregation and expansion of sound training methods.

Among the many musical genres, few have been as popular as vocal music, both long-standing and ever-evolving, simultaneously widely loved, yet difficult and subtle. A review of the history of both Chinese and Western vocal music reveals over 70,000 topics in English literature, with nearly 20,000 focusing on this field. Particularly in the study of vocal music history since the founding of the People's Republic of China, there are 22 primary topics in over 60,000 articles, with more than 10,000 articles on vocal music teaching

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and 8,965 articles concerning the glottis and glottal impact. This highlights the significance of the glottal impact theory in vocal music research. In fact, since the publication of Shang Jiayang's *Bel Canto Overview* in 1982, only 13 researchers have mentioned micro-coughing (including similar expressions, based on incomplete statistics). Therefore, in the overall study of the glottal impact theory, a small number of people are familiar with the substantial contribution of Manuel García's micro-cough theory to the development of glottal impact theory [1].

3. Research Objectives

Clarify the basic principle and training method of micro-coughing. Clearly and in detail explain the basic principles of micro-coughing, including its theoretical foundation, operational mechanism, and unique training methods, so that readers can fully understand and master this technique [2].

Explore the influence of this practice mode on the vocal skills, expressive power, and physiological mechanisms of vocal performers. Conduct a thorough and systematic exploration of how this vocal practice mode influences the improvement of vocal skills, enhancement of expressive power, and physiological mechanisms, analyzing its internal logic and scientific basis.

Suggestions on vocal music teaching and practice based on the training mode. Based on practical experience, provide a series of suggestions for vocal music teaching and practice that incorporate the sound practice mode. These suggestions aim to assist vocal music teachers and students in using this mode more effectively in the teaching and learning process, ultimately improving the level of vocal music education and performance.

4. Background of the Subject

First of all, personal experience: reviewing the personal experience of professional vocal music teaching for more than 30 years, the author deeply feels that several major changes in the process of vocal music learning are related to the glottal impact theory of Little García. The first turning point was in Chongqing Teachers College. It was the first time that I came into contact with micro-sound singing from Professor Jiang Shixiong. I was taught by his words and deeds. Thereupon, I observed the instruction and demonstration by numerous pupils and gained a lot of profound inspiration. Looking back, the secret of Pei's vocal music teaching is Little García's micro-cough, non-cough theory. The micro-cough, non-cough theory is the premise of the eventual perfection of Little García's theory. That is to say, before the micro-cough, non-cough theory, European vocal music had never fully incorporated Little García's vocal music theory. However, since 1894, when Little García published *Hints on Singing*, illustrating the micro-cough, non-cough theory, his theory began to be widely accepted in vocal music [3].

The second major turning point was in Three Gorges University, where Mr. Gao Ming reiterated the significance of vocal cord closure for vocal music through demonstration and explanation. After more than 10 years of research, he summarized the theory of vocal cord closure as the core and obtained three invention patents in vocal music teaching. Reviewing the course of the development history of European vocal music, it is not difficult to find that the concept of vocal cord closure is actually the core viewpoint of García's glottal impact theory and also the cornerstone of the whole glottal impact theory.

The third major change was in the vocal music major of the Central Conservatory of Music. I thought I had a foundation built over decades. However, after Zhang Mingming imitated my singing, I immediately found that I had the problem of supporting my throat and suffocating my voice. Under the guidance of Mr. Zhang, I finally got a professional score of 88 points. The sound-open consciousness of Little García's glottal impact theory in the Chinese vocal music circle has never declined since 1997, especially reaching an unprecedented height in the past 10 years. Furthermore, the sound-open consciousness has become the basic proposition of the psychological function school. To take a simple

example, in China, since 1986, there has been endless research on his vocal music open timbre awareness. Until 2024, there are still two master's theses discussing the outreach characteristics of singing timbre, both of which are closely related to him [4].

The fourth major change was in the mid-term exam of the Wheat Ear Vocal Music Master Class. In view of the voice pressure problem, the instructor personally introduced an open-mouth humming correction program. Through opening the mouth while humming, I truly understood the meaning and value of the training mode of humming and mother sound. Reviewing the historical origin of the humming training method proposed by tenor Li Shuangjiang in the 1980s, it is a variant of Little García's glottal impact theory, which always emphasizes the core of vocal cord closure, fully adjusts the proportional weight function of the vocal cords, and realizes the best mixing ratio across the full vocal range.

Secondly, a small cough is the active choice in the development history of vocal music. Reviewing the development history of European vocal music from a macro perspective, it can be roughly divided into three stages: primitive, religious, and bel canto. Among them, bel canto is particularly significant, representing the peak of professional vocal music development. The development history of bel canto spans about 400 years. During the 17th and 18th centuries until the early 19th century, Baroque and classical vocal studies mainly focused on breath control, and resonance research was in its infancy. Beginning in the early 19th century, Romantic music flourished, and Coliseum opera placed higher demands on resonance, leading to the emergence of the resonance school. However, excessive resonance subsequently caused frequent occurrences of catastrophic vocal cord diseases.

In the mid-19th century, laryngeal research, marked by Little García's glottal impact theory and the invention of the laryngoscope, continued into the 20th century, incorporating psychological, functional, and physical principles. In the 21st century, research has followed the path of Little García's glottal impact theory, integrating laryngeal research with psychophysiological studies, forming a diversified model of mutual penetration and integration.

Obviously, Little García's glottal impact theory not only solves the problem of weak vocal cords among singers and their predecessors but also effectively prevents physiological strain caused by excessive resonance. Therefore, choosing Little García's glottal impact theory as the guiding ideology of vocal music teaching and singing is the correct, inevitable, and active choice in the development history of European bel canto vocal music. In this sense, selecting micro-cough as the entry point for the core topic of this paper is also an inevitable choice from the perspective of the development history of vocal music.

Finally, a small cough is the focus of several important issues in vocal music teaching research in recent years. In essence, a small cough is a concentrated and perfected form of the glottal impact theory. In the 20th century, the glottal mixed school and the school of mental function directly or indirectly inherited its positive results. Especially at the beginning of the 21st century, the glottal impact theory has become the core, and psychology, physiology, physics, and other disciplines have converged, jointly shaping a diversified and international new pattern of vocal music development.

At the same time, several major issues and practical problems exist in vocal music teaching research, and their internal mechanisms focus on the core argument of the small cough. In general, there are mainly five: prioritizing technique while neglecting sound practice; excessive volume causing resonance to become uncontrollable; emphasizing vocal characteristics while ignoring the unity of vocal range; weak breath support leading to weak vocal cord closure, tight throat, and weak performance [5].

The core idea of the small cough is closely related to vocal cord closure, as vocal cord closure is the premise of achieving a mild cough. To achieve effective vocal cord closure, adequate training in vocal cord function must be performed, as described in the reference material. Secondly, the volume emphasized by the micro-cough is achieved through glottal impact greater than the minimum volume of a whisper, ensuring effective vocal cord

vibration at minimal volume while allowing for the aggregation and expansion of singing resonance. Thirdly, the successor of micro-cough is the mixing ratio of the individual throughout the full vocal range.

Fourthly, the micro-cough, non-cough technique primarily involves the oropharynx and requires amplification through five levels: vocal cords, chamber, epiglottis, oropharynx, and orbicularis oris muscle. The core of this technique is effective polymerization and expansion at each level, which is physiologically and physically supported by strong, agile, and moderate bite force combined with external force.

5. Research Meaning

5.1. Investigate the Principle Deeply, and Be Easy to Operate

Action is the foundation of knowledge, and knowledge is the key to successful action. More than 30 years of rigorous exploration, combined with the deep integration of over 400 years of bel canto development, aim to thoroughly understand the essence of micro-cough and apply its fundamental theory to vocal music teaching practice. Micro-cough has not been effectively incorporated into vocal music teaching practice, and this theory has been specifically transformed into the NGU functional sound training mode.

Firstly, the subyin "ng" as the soft onset mode of the posterior nasal sound following the compound subyin "nk" can more effectively promote vocal cord vibration, soften explosive sounds, enhance the synergistic effect of the vocal cords, resonance chamber, epiglottis, oropharynx, and orbicularis oris muscle, while also improving both its bite force and expansion capacity. The vowel "u" is the most moderate among the five primary vowels. Although the vowel "a" has historically held a high status, modern vocal music teaching favors the "u" vowel — a fact supported by professional searches in the CNKI database.

- 1) FT = "u vowel" AND SU = "vocal" → 1,112 results
- 2) FT = "u vowel" AND FT = "vocal" → 1,769 results
- 3) TI = "u vowel" AND FT = "vocal music" → 6 results
- 4) FT = "a vowel" AND SU = "vocal" → 912 results
- 5) FT = "a vowel" AND FT = "vocal" → 1,542 results
- 6) TI = "a vowel" AND FT = "vocal music" → 1 result

The core of the small Garcia glottic impact theory always centers around effective vocal fold vibration, with the parent sound being the most basic mode of vocal fold vibration. Using microcough without cough as the guiding principle for mother sound training in the ngu function sound mode ensures vocal fold vibration at the minimum volume, while also accounting for the effective aggregation and expansion of the five-level resonance amplification involving the vocal folds, chamber, epiglottis, oropharynx, and orbicularis oris muscle [5].

5.2. Review the History, Inherit the Essence to Open a New Chapter

As mentioned above, choosing Garcia's theory as the guiding ideology for vocal music teaching and singing is the correct, inevitable, and active choice in the history of European vocal music. From the perspective of vocal music history, it not only prevents the weakening of vocal cord function during the classical period but also absorbs insights from the Romantic period, strengthening the function of the vocal dynamic system with the least effective volume.

5.3. Strengthen the Basis of Physiological Physics of Perceptual Vocal Music Teaching, and Return to the Right Way of Academic Guidance

Generally speaking, traditional vocal music teaching focuses on the method of oral transmission and understanding. Some industry experts believe that the tradition of vocal music schools contains unspeakable mysteries, which can only be conveyed face-to-face to truly achieve the tacit understanding between teacher and apprentice. From the litera-

ture records, this is an indisputable fact: at least since the founding of the People's Republic of China, the study of the vocal music teaching mode of oral tradition began with the inheritance of new opera vocal music, followed by the integration of Chinese classical opera works. In the field of pure vocal art, this began at least in 1963, and later became more intensive, reaching nearly 600 articles per year by 2020. Overall, there has been no significant decline in this trend. Therefore, it is clear that paying attention to the auditory characteristics of vocal music art is fundamental and in line with the nature of the art itself.

However, the proportional relationship between vocal perceptual research and rational research seems to present another thought-provoking question:

- 1) FT = vocal AND FT = rational, search result: 51,344
- 2) FT = vocal AND FT = perceptual, search result: 36,970

Now, let's interpret the meaning of comparing these two sets of data: when discussing vocal music in the full text, the proportion of articles emphasizing rationality over those emphasizing sensibility is $(51,344 - 36,970) / 36,970 = 38.88\%$, nearly 40%. This indicates that people tend to prioritize feasibility in practice, while theoretical research focuses more on academic and logical aspects.

How can we resolve the contradiction between academic research and actual teaching in vocal music? In short, we must take reason as the rudder and sensibility as the sail. Thus, the choice to study the phenomenon of micro-cough is to strengthen the guidance of Garcia's glottic impact theory in vocal music teaching, emphasize quality singing with the minimum volume, and enhance the training of soft mother sound while strengthening the effective aggregation and expansion of resonance.

In the practice of vocal music training, the micro-cough ngu sound training mode not only requires practitioners to have a solid vocal foundation but also demands keen hearing and perceptual ability to accurately capture the sound effect of micro-coughing and continually adjust and improve. Additionally, this training mode needs to integrate scientific breathing techniques and laryngeal muscle control to ensure sound quality.

In the practical application of the micro-cough ngu sound practice mode, practitioners can gradually improve their vocal skills and expressive power through different practice methods and tracks. For example, they can feel and understand the characteristics and charm of the sound by practicing classic tracks while also testing and improving their vocal results by practicing different styles and levels of difficulty [6].

Specifically, this research will fill the theoretical gap in the study of micro-cough both domestically and internationally, providing a more scientific and systematic theoretical basis and practical guidance for vocal music teaching [7]. Through an in-depth study of micro-coughing, we can not only better understand the physiological mechanism of vocalization but also provide more effective training methods for vocal learners, helping them master vocal skills faster and improve their performance. At the same time, this research will inject new vitality into vocal music teaching and promote the continuous development of vocal music art.

In short, as a new vocal music training method, it provides a fresh perspective and approach to vocal music teaching while injecting new energy into the development of vocal music art. It is believed that in the future, this vocal practice mode will be more widely applied and promoted in vocal music education and artistic practice. At the same time, we hope that more vocal music enthusiasts and professionals will join in the research and exploration of this field, collectively promoting the development and progress of vocal music art. Ultimately, the goal is to strengthen the foundation of emotional vocal music teaching and ensure that vocal music education returns to an academic track [8].

6. Research Technique

Literature Review Method: This method systematically combs through and analyzes the relevant literature on micro-cough, micro-fibrillation skills, and the ngu function sound practice mode. The goal is to summarize the current research status in these fields

and explore future development trends, thereby providing theoretical support for vocal music teaching and research [9].

Experimental Research Method: This study will design a series of comparative experiments to carefully observe and record the sound skills, expressive power, and related physiological mechanisms of vocal performers before and after adopting specific vocal practice patterns [10]. By comparing the experimental results, the study aims to explore the specific impact of these practice patterns on the technical level and artistic performance, as well as the potential positive physiological changes.

Data Analysis Method: Based on the experimental research, this study will use advanced statistical methods to conduct in-depth processing and analysis of the collected experimental data. Through rigorous data analysis, the study will verify the research hypotheses proposed before the experiment, ensuring the accuracy and reliability of the results, and providing a scientific basis for optimizing vocal music teaching and training methods [11].

7. Review of Related Research Literature

Based on the background of the topic and the statement of the research significance, we have identified three main topics related to micro-cough for the literature review: function, external laryngeal muscle relaxation, and the small fibrillation humming maternal sound practice mode [12].

7.1. Function

The laryngeal muscles are divided into two categories: internal and external. The internal laryngeal muscles consist of three groups: arytenoid, cycloarytenoid, and epiglottic. The external laryngeal muscles, based on their functional differences, are divided into two groups: the shortened vocal tract muscle group and the prolonged vocal tract muscle group. To focus on solving the core issue of glottic impact (vocal cord closure), the general external laryngeal muscles are categorized as part of the internal laryngeal muscle group [13].

In functional research, glottic shock theory emphasizes the significant role of the cycloarytenoid muscle in the vocalization process. Garcia believed that the vocal cords are attached to the thyroid cartilage, and the stable low throat position allows the cricothyroid muscle to strengthen the longitudinal tension on the vocal cords, tightening them and keeping them in a light functional state. In this state, the vocal fold edges vibrate, producing a bright, plump, relaxed, and rounded sound quality. At the same time, maintaining a stable low throat helps to straighten the posterior pharyngeal wall and fully open the throat, effectively preventing breath from floating or becoming sluggish. In short, Garcia's concept of light function in singing was attributed to the cricothyroid muscle.

At the end of the 20th century, He Ping demonstrated that the special muscle structure of the arytenoid muscle could generate both an acoustic zone and a leptogenic zone. The arytenoid muscle has a unique muscle structure, containing longitudinal, transverse, and oblique muscle fibers. The contraction of the longitudinal fibers closes the glottis, while the contraction of the transverse fibers opens it. The oblique fibers of the arytenoid muscle extend from the arytenoid cartilage to the free margin of the vocal cords. When these fibers contract with the transverse fibers, the vocal cords move outward from the midline. In other words, the arytenoid muscle can produce both chest sounds in the stressed area and falsetto in the softer area. While the arytenoid muscle can produce falsetto, it is the dominant muscle in falsetto production, and its combination with other muscles enriches the sound further [14].

Research has shown that the synergistic effect of the cricothyroid and arytenoid muscles on the vocal cord body results in the realization of their functions through the vocal cords themselves. The functions of the cricothyroid and arytenoid muscles are achieved through the dual vibratory structure of the vocal cords: the cover (vocal cords + superficial

layer of the lamina propria), the body (elastic conus + vocal cord muscle), and the transitional part (the middle layer of the body, which consists of the middle and deep layers of the lamina propria).

The external laryngeal muscles responsible for shortening the vocal tract include the mandibular hyoid muscle and the hyoid muscle. The external laryngeal muscles that lengthen the vocal tract include the thyrohyoid, scapular hyoid, and sternal carmoid muscles.

7.2. *Relaxation of the Extralaryngeal Muscle*

Little Garcia believes that the primary and core task of the external laryngeal muscles is to achieve complete relaxation. However, after nearly 200 years of continuous exploration in the global vocal music industry, researchers have gradually summarized some external performance indicators of external laryngeal muscle relaxation. These indicators include yawning, semi-yawning, yawning starting state and jaw lift and mouth opening [15,16].

7.3. *Microtremor Hum Mother Sound Practice Mode*

Under the influence of the theory of relaxation of the external laryngeal muscles, to effectively express aesthetic emotions such as excitement, desolation, and loneliness, the discipline of vocal psychology was established. In 1954, *Nature* published an article titled "Acoustics of Song" which explored the relationship between microfibrillation and glottal shock [17] and noted that both are important for well-trained singers. In the 1980s, voice practice began to be widely adopted [18].

Humming, or mouth hum, specifically refers to the sound produced through the nostrils [19], and is also used to describe the low chant "oh" [20]. In the 1930s, humming became associated with singing [21]. Humming entered the field of vocal music research in the 1950s [22]. The term "hum" first entered the research focus in the 1960s, not to solve pure vocal issues, but as an accompaniment to quyi singing [23]. In the 1970s, humming officially entered the field of vocal music [24]. As a research theme, it began in the 1980s, with vocal music training types discussed in 1980 [25], and the concept of 'm' introduced in 1983 [26], followed by Ai Kailing in 1987 [27].

The master sound practice mode of vocal music has a long history in countries worldwide. After the founding of the People's Republic of China, China widely adopted the combination of female pronunciation and national language singing, based on the nationalization of European singing styles [28].

The first articles discussing microtremor, humming, and mother sound exercises appeared in the 1980s [29]. However, despite nearly 40 years having passed, the subtle humming silent practice pattern has yet to be established.

8. The Existing Literature Provides a Research Space for the Topic

In conclusion, the existing literature provides the following research space for the following three aspects

8.1. *Musical Training*

Based on the core principles of glottic impact theory, which includes the source of high-quality mixed sound ratio, vocal cord closure, and the method to obtain a high-frequency resonance peak:

Source of High-Quality Mixing Ratio: When the vitality of the arytenoid muscle exceeds the rigidity of the vocal fold, it results in stress, chest sound, or severe mixing. Conversely, when the vitality of the cycloarytenoid muscle is relaxed, the body strength and the cover strength are balanced, producing falsetto, soft tone, or mild mixing [24-27].

Vocal Cord Closure: The fundamental function of vocal cord closure cannot be achieved without the key role of the arytenoid muscle and the lateral muscle of the arytenoid ring [30].

Method to Obtain High-Frequency Resonance Peak: The epiglottis, as part of the vocal band and channel, plays a role in both sound transmission and filtering, which is evident in the resonance peak spectrum analysis. The transmission refers to the resonance aggregation of the vocal cords, chamber belt, epiglottis, oropharynx, and orbicularis oris muscle—forming the third level and expansion of resonance. The filtering process uses the space between the coiled epiglottis and vocal fold to create frequencies of 2600-2800Hz (for males) and 3000-3200Hz (for females) [31].

8.2. Relaxation of the Extralaryngeal Muscle

A proper relaxation method for the external laryngeal muscles was initially discovered. However, since these methods focus more on external performance rather than auditory effects, could we explore a song-effect-oriented mode of operation? This will be the main direction of this article: the microfibrillation sound mode.

8.3. Practice Mode of Microfibrillation Hind Nose Hum

As mentioned earlier, although microfibrillation has been one of the eight basic symbols of bel canto timbre for over 400 years, it remains one of the most common yet unsuccessful attempts in the vocal world. Humming vocal practice is widely used within the vocal music community, with anterior nasal humming and parent sound training being particularly common. However, the posterior nasal and parent sound mode provides greater resonance aggregation and expansion, helping to open the oropharynx. Therefore, constructing a sound research pattern will be the core goal of this paper.

Furthermore, to better reveal the internal connection between uncough and the ngu sound mode, it is essential to clarify the historical development of glottic impact theory, in order to uncover the concepts and paths for constructing the ngu sound mode.

9. Main Direction

9.1. Glottis Impact of the Past Life

Although it is widely believed that the opera *Juliici*, written by Perry in 1600, marked the formation of the bel canto school, in fact, the opera *Juliice*, created by Perry in 1599, is the earliest known opera. The *Orfeo* by Montverdi, created in 1607, is considered the father of modern opera, having a profound influence on the formation of the bel canto school and the development of the vocal performance system. The French Revolution in 1789 gave rise to the romantic social trends of thought, and the revolutionary ideals of liberty, equality, and fraternity promoted the demand for individual freedom and emotional expression. During this period, the dramatic conflict in vocal music intensified, leading to the decline of the traditional role of singers. Vocal works began to demand higher requirements from artists in terms of vocal range, volume, and resonance. Composers like Haydn, Mozart, and Beethoven were influenced by revolutionary ideas, reflecting the transformation of musical art during this time. As a result, many singers in the early 19th century used excessive voice, causing vocal strain and even loss of voice, forcing many to leave the stage. To meet the demands of romantic dramatic vocal performance, the glottal impact theory emerged. Alongside the small Garcia and glottic impact schools, vocal psychology and psychological muscle energy became integral aspects of vocal development.

In the early stages of the glottic impact theory, research focused on the physiological muscle energy of the larynx. It began with the exploration of the physiological muscle energy in singing and its motivation, followed by the establishment of the basic framework for glottic impact theory. The core technical aspect of this theory was vocal cord closure, with the extension of this research into the relaxation of external laryngeal muscles.

Although they were contemporaries, one was eight years older and passed away six years earlier. The theories of the older figure, to some extent, inherited the physiological science approach to vocal music teaching from the other's work and, through development and innovation, especially in respiratory control and neural control, can be seen as an extension of the glottic impact theory.

Salvatori, Maracci, and his wife, along with singers like Tezini and Gili, inherited and further developed the Galician School. Mrs. Maracci trained many famous sopranos, such as Melba, Calvi, Emma Imes, Alda, and contralto Klausley. She also authored 24 volumes of vocal training courses, a memoir, and a vocal monograph on 'bel canto singing.' She was the first to refer to the voice in the middle register as 'mixed sound' and made many insightful contributions to the concept of unifying vocal registers.

Contemporary American singer Richard Alderson developed the glottal impact theory into the "glottal touch theory" [23], which further enriched the application of glottal impact theory in modern vocal music teaching. According to Alderson, glottal touching is a more delicate and flexible vocal technique that emphasizes adjusting the contact mode and intensity of the vocal cords to achieve a richer and more delicate sound. This skill not only helps protect the vocal cords and reduce damage, but also enables singers to express their emotions more freely during performance, thereby enhancing the musical expression.

Alongside the nearly two-century-long tradition of the glottic impact school, the psychological energy school, represented by Van Ard, has also made contributions to the study of vocal techniques, particularly the "small cough" skill. Van Ard studied the vibration principles of vocal cords for many years, using physiological and physical theories to demonstrate that the varying lightness and heaviness of vocal cord vibrations are fundamental to the different vocal registers of singers. This theory, to some extent, echoes Garcia's "glottal impact" theory and provides a scientific basis for vocal music teaching. For example, Van Ard used scientific experiments to disprove the importance of "sinus", "head cavity resonance", and "nasal resonance", while proposing the crucial role of the trachea and bronchi in resonance. This concept is somewhat similar to Garcia's "glottic shock" theory. Furthermore, small coughing is not only a vocal technique but also a psychological adjustment method. Through small cough practice, singers can learn to remain relaxed and focused during performance, improving control over their breathing, voice, and resonance, and making their singing more natural and smooth.

Since China's reform and opening up, the Chinese vocal music school has widely absorbed the positive achievements of European traditional bel canto art. Little Garcia's vocal music theory and teaching methods have been adopted in Chinese vocal music education and singing practice. Garcia, recognized globally as an authority in vocal music teaching and theory, proved the physiological and physical validity of the classical Italian bel canto school's techniques with his "glottal impact" theory. He theoretically summarized the bel canto method, offering a more conscious and clear way to practice vocal sound. Specifically, Garcia's two-mouth theory had a significant influence in the 1990s. In the process of learning and practice, Chinese vocal music educators and singers have drawn from Garcia's methods, advancing the development of Chinese vocal music. Furthermore, Garcia invented the laryngoscope, published the theory of "glottal impact" opened the door for voice research, and promoted extensive, in-depth, and scientific exploration of vocal mechanisms. As a result, he is often referred to as the "father of voice science" His contributions not only laid the foundation for the bel canto school but also provided valuable theoretical support and practical guidance for the development of vocal music in China.

In conclusion, the glottal impact theory and related studies provide rich theoretical support and research opportunities for this paper. In exploring the micro-cough technique, this paper will build on previous research, incorporate the needs of modern vocal music teaching, and strive for innovation and breakthroughs in both theory and practice.

9.2. Achievements and Problems: Based on the Glottal Impact Theory of Muscle Energy Research Progress

As mentioned above, significant breakthroughs have been made in the study of glottal impact theory, particularly in the areas of high-quality mixed sound ratio, vocal cord closure, and methods for obtaining high-frequency resonance peaks.

The current core challenge is how to effectively translate these research findings into practical, impactful applications on the vocal music stage. One of the most direct and simple methods is vocal training. To address this, this paper proposes a concise and efficient strategy: based on Garcia's technique, the transition from microfibrillation + nka to microfibrillation + nga will ultimately enable the aggregation and expansion of microacoustic nga, which can then be applied in vocal training.

9.3. A Polyization and Expansion of Microcough-Nkanga-Microfibrillation Ngu

9.3.1. A Microcough of the Mother Tone without Cough

The glottic impact theory of Little Garcia, considered the perfect form of bel canto, is comprehensively inherited and developed through the microcough technique of "A mother sound" This technique encapsulates the essence of bel canto from the 17th to 18th centuries, covering eight key aspects of vocal art development during this period:

Breathing: The technique of microcough, not cough, reflects the baby's laughter, symbolizing innocence. It emphasizes deep breath control and strict management of explosive force, aligning with the natural and pure aesthetic pursuit of vocal music psychology. This also supports the bel canto school, which regards breathing as the foundation of singing, incorporating both physiological principles and methods of breath control.

Sound: Microcough, not cough, focuses on weak sound versus hard sound and soft sound. This fully inherits the foundational principles of traditional bel canto singing, enabling a delicate and controlled vocal output.

Sound Quality: As the complete form of the glottic impact theory, microcough ensures good vocal cord closure, leading to effective vocal vibration. This results in a plump, round, relaxed, bright sound with a metallic color and rich resonance—essential qualities that are at the core of bel canto singing.

Harmonization of Sound Area: By adjusting the synergistic effects of the arytenoid muscle and cricothyroid muscle, and controlling the strength of the vocal cords and cover, the optimal sound mixing ratio can be achieved. This ensures the unity of sound across the entire vocal range, continuing the tradition of unified sound areas in bel canto.

Coherence: Continuous use of microcough without cough inherits the coherent historical tradition of bel canto, ensuring smooth transitions and consistency in vocal performance.

Volume: Through the principles of bel canto, microcough inherits the tradition of controlled volume, allowing singers to maintain consistent sound dynamics.

Microfibrillation: The concept of microcough inherits the natural and relaxed approach to sound from early bel canto, contributing to the birth of vocal music psychology in the early 20th century.

Dexterity and Elasticity: The combination of glottic impact, microtremor, relaxation, and natural state, alongside the clever use of microcough and no cough, perfectly carries forward the tradition of dexterity and elasticity in bel canto singing.

9.3.2. Micro Cough

According to the 1894 description, the "mother sound" used at that time was "a", while the sound associated with a small cough was "ka". The sound of no cough was "ga", whereas the soft sound variations were "nka" or "nga".

9.3.3. Polymerization and Expansion of Microfibrillation Ngu

Microcough, as a form of noise, is represented by nka, while no-cough is denoted as nga. In the early stages of glottic impact theory, the a-sound was widely used. However, in contemporary vocal practice, the u-sound has become more common. For example, a search of vocal music literature shows 1769 results for "u", surpassing 1542 results for "a", demonstrating this trend.

Therefore, in the modern adaptation of small cough theory in Little Garcia's framework, the appropriate form should be ngu.

Little Garcia fully inherited the bel canto tradition of microfibrillation, and the vocal psychology he conceived in the 1930s has continued to influence vocal practice. For example, CNKI search results combining microfibrillation with famous vocalists are as follows:

FT= Pavarotti AND FT= microfibrillation → 60 results

FT= Domingo AND FT= microfibrillation → 49 results

FT= Carras AND FT= microfibrillation → 20 results

FT= Liao Changyong AND FT= microfibrillation → 27 results

Given that microfibrillation possesses microacoustic, natural, and relaxed properties, the complete form of microcough should be ngu + microfibrillation, or simply microfibrillation ngu.

Functional Advantages of Microfibrillation ngu:

Ensures vocal practice remains in a microacoustic, natural, and relaxed state.

Supports moderate soft-tone resonance aggregation and expansion.

Maintains optimal vocal tract conditions for effective sound aggregation and controlled expansion.

10. Research Conclusions

This article aims to clarify the fundamental principles and training methods of the microfibrillation sound mode, a distinctive vocal practice technique. It will explore in depth the acoustic practice pattern of microcough, analyzing its underlying principles and systematic training approach.

Furthermore, this paper will examine in detail how this practice pattern influences vocal technique, expressive power, and the physiological mechanisms of vocal performers. A comprehensive analysis will be conducted on how vocal performance skills can be enhanced, how vocal quality can be improved, and the potential physiological impact of this technique on performers.

Based on the microfibrillation ngu sound mode, this study will propose practical vocal training programs and instructional guidance. These programs aim to offer strong theoretical support and a clear practical framework for fostering innovation in vocal music. By implementing these structured training methods, we seek to provide a scientific foundation and effective pedagogical approach to advance the development of vocal artistry.

11. Postscript

Microfibrillation ngu, as a mode of vocal training, traces its theoretical origins to the microcough technique derived from the mother sound of small Garcia, while its practical application emerged in the 1980s. At that time, renowned tenor Li Shuangjiang delivered a lecture on China National Radio on how to sing high notes. His vocal exercises were largely based on humming, with a distinct emphasis on anterior nasal humming. Observing Li Shuangjiang's vocal career, the incomplete vocal cord closure exemplified in *Good-bye, Mom* during the 1980s appears to have been widely acknowledged by professionals in the vocal music field.

This raises the question: was Li Shuangjiang's incomplete vocal cord closure caused by anterior nasal humming? The answer is no. Anterior nasal humming itself is merely a phonation technique that involves nasal resonance and articulation adjustments, rather than directly contributing to poor vocal cord closure. The closure of the vocal cords is

more closely related to physiological conditions, pathological changes, and vocal cord usage.

Another question follows: is anterior nasal humming related to air leakage? Surprisingly, the answer is yes. While anterior nasal humming does not directly cause vocal cord leakage, it can lead to nasal leakage. This occurs because excessive reliance on nasal resonance allows airflow to remain in the nasal cavity for an extended period. If the airflow is not redirected in time, nasal leakage may occur. However, this is fundamentally different from glottic leakage caused by poor vocal cord closure.

That being said, does anterior nasal humming always result in nasal leakage? Not necessarily. If the speaker properly controls the airflow within the nasal cavity, nasal leakage can be prevented. Given these characteristics, is anterior nasal humming an effective vocal training technique? The answer is a resounding yes.

Academically, anterior nasal humming helps vocalists locate high-frequency resonance points and refine oral resonance, thereby enhancing vocal tone, enriching resonance, and expanding vocal range. In practice, anterior nasal humming effectively relaxes the throat muscles, prevents tension, protects the vocal cords, improves coordination among vocal organs, optimizes airflow distribution, enhances vocal stability, and increases expressiveness, making the voice more fluid and controlled.

With so many advantages, is it necessary to implement posterior nasal humming? Absolutely. Posterior nasal humming encompasses many of the benefits of anterior nasal humming, such as high resonance and throat relaxation, while also addressing its limitations in vocal cord closure and oropharyngeal expansion. Although anterior nasal humming contributes to vocal agility and brightness, posterior nasal humming plays a crucial role in adding depth and dramatic effect to the vocal timbre. For professional singers, this depth is essential for enhancing emotional expression and elevating artistic performance.

By integrating anterior and posterior nasal humming into vocal training, singers can comprehensively refine their technical skills and enhance the depth and resonance of their voice. Posterior nasal humming, by strengthening high-frequency resonance and promoting throat relaxation, adds layers and penetration to the sound, which is particularly important for conveying complex musical emotions and intricate character expressions. Therefore, mastering posterior nasal humming is an indispensable step for vocalists seeking artistic refinement.

Cheng Zhi, a singer of the same era as Li Shuangjiang, demonstrated superior vocal cord closure and achieved remarkable success in vocal pedagogy. His students, such as Yan Weiwen, Liu Bin, and Mai Sui, all won gold medals in the National Youth Song Competition, highlighting his exceptional teaching methodology.

As a disciple of Cheng Zhi and Mai Sui, the author has adapted Cheng Zhi's vocal teaching philosophy and refined Li Shuangjiang's anterior nasal humming technique, ultimately forming a subsound training system centered around ng-based vocalization. This system integrates the u mother sound, which is widely used in vocal training, and incorporates microfibrillation to ensure a natural and relaxed microsound.

So far, this study on the practice mode of microcough without cough has reached its conclusion. It is evident that microcough represents an optimized application of glottic impact theory, which is a fundamental concept in vocal music pedagogy. As an important theoretical framework, it provides new insights and methodologies for the study of vocal techniques.

Through a comprehensive review of research on laryngeal muscle function, respiratory mechanics, and vocal training techniques, and drawing from over thirty years of personal experience in vocal learning and teaching, the author has developed the microfibrillation ngu functional training mode. This model aims to provide a reference and experimental approach for vocal pedagogy. However, certain historical aspects of vocal technique remain unresolved, such as the formation of the historical tradition of bel canto singing. While some sources, such as the works of Shang Jiexiang, provide valuable insights, they may be limited to secondary or tertiary materials.

Nevertheless, the development of bel canto, originating in 17th-century Italy and evolving through its golden age, subsequent innovations, and scientific advancements, has laid a solid theoretical foundation for the scientific and artistic aspects of classical vocal technique. During doctoral research, further studies will be conducted to deepen the understanding of these historical developments in relation to the subject.

Despite the methodological rigor of this study, the complexity of vocal artistry suggests that there may still be areas for improvement. Therefore, experts in relevant fields are sincerely invited to provide valuable comments and suggestions to further refine this research.

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