The Olympic Singer: Integrating Pilates Training Into the Voice Studio

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THE OLYMPIC SINGER: INTEGRATING PILATES TRAINING INTO THE VOICE STUDIO

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ABSTRACT

The Olympic Singer: Integrating Pilates Training into the Voice Studio

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The objectives of the document are to define potential synergies and benefits in the application of Pilates method physical training to versatile and high-level voice performance, and to develop an integrated vocal pedagogy-Pilates method to improve voice performance.

According to Richard Miller and D. Ralph Appelman, it is well established that correct breathing, posture and body mechanics all play a role in basic vocal technique. Versatile and high-level voice performance training requires still higher levels of muscular coordination, endurance, and a stronger mind-body connection to develop an aesthetic technique and avoid potential vocal injury. As maintained by the DK Body Balancing Method, Pilates is a system of exercises that conditions both the mind and the body, focusing on body alignment and correct breathing. Pilates exercises have been shown clinically to strengthen muscles and increase control, flexibility and coordination.
Therefore, integrated vocal and Pilates training has the potential to improve voice performance and to develop a physiology that avoids overuse injury.

Proprioceptive neuromuscular facilitation (PNF) underlies the mind-body benefits of both good vocal training and of Pilates workouts. Proprioception is the conscious and unconscious neuromuscular regulation of posture, movement, balance and body position.¹ It is in essence “body awareness.” Biomechanics on the other hand is “the study of forces on the skeleton and how they affect joint mobility and stability.”² I propose that singers trained with Pilates exercises that target the specific muscle groups fundamental to volition and respiration in the vocal process, will develop, through PNF, better singing biomechanics and mind-body awareness during vocal performance.

The application of the integrated vocal pedagogy-Pilates method requires education and experience as a trained singer and voice teacher, as well as Pilates trainer certification in mat repertoire and props including big ball, small ball and Theraband.² The method will be represented by a chart summary of an exercise series for training singers, and supported by appropriate evidence-based literature on proprioception, PNF and related mind-body techniques that span the separate teaching techniques of vocal pedagogy and the Pilates method.

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CHAPTER 1

INTRODUCTION

It is the responsibility of the singing teacher in a scientific age to interpret and expand vocal traditions through the means of current analysis so that the viable aspects of tradition can be communicated in a systematic way.

Richard Miller, “The Singing Teacher in the Age of Voice Science”

Voice pedagogy can integrate the techniques of Pilates-based physical training to yield improvements in voice performance training. In order to develop a method for voice performance training which integrates knowledge and strategies from both techniques, a common language integrating the two must be developed. Once the language is unified between the techniques, an integrated regimen can be created and then practiced by students of voice performance who study with teachers trained in both voice performance and a method of Pilates-based physical training.

Since there is no exercise regimen specific to singers in Pilates-based physical training, it is necessary to create a methodology that can derive an integrated method. This paper will suggest a sequential protocol for deriving a Pilates-based physical training method. Once this is developed, it could be used to enhance voice performance training. The sequential steps used in the methodology would identify and define potential synergies between singing and Pilates-based exercises, and will also draw parallels between the two

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techniques using the science of human kinetics, also known as kinesiology. To understand how an integrated method using voice pedagogy strategies and Pilates-based physical training is derived, it is necessary to have a general knowledge of the physiological, biomechanical, and anatomical aspects of singing and Pilates-based physical training.

Singing is a technique that requires a well-balanced effort in muscular coordination and a skilled mind-body performance. A controlled inspiratory and expiratory rhythm must be properly maintained to produce a voice which is not only pleasing to an audience but also delivers harmonized acoustic vibrations. Correct breathing, posture and body mechanics all play a role in good singing. In vocal pedagogy, posture and breathing with mind-body connections are emphasized as main areas of focus in training to improve voice performance.

When singing, a person’s sense of orientation, otherwise known as proprioception, plays a fundamental role in correct breathing, good posture and well-coordinated body mechanics. Proprioception is based on the neuromuscular system involving both nerves and muscles. Proprioception is the conscious and unconscious regulation by the neuromuscular system of posture, movement, balance, and body position. Proprioception manages body awareness based on the sensations received by afferent nerves that transmit, interpret and respond to messages by stimuli in the “muscles, joints

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4 Webster's New Universal Unabridged Dictionary, s.v. "Kinesiology." The term kinesiology is defined as “the science dealing with the interrelationship of the physiological processes and anatomy of the human body with respect to movement.”


6 Webster's New World Medical Dictionary, 3rd ed., s.v. "Afferent nerve." The term afferent nerve defined as “a nerve that carries impulses toward the central nervous system (CNS). The opposite of an afferent nerve is an efferent nerve that carries impulses away from the CNS.”
and tendons." When combined with biomechanics, proprioception addresses the complete coordination of the neuromusculoskeletal system (i.e. nerves, muscles, and bones). Biomechanics is based on the musculoskeletal system. Breibart defines it as "the study of forces on the skeleton and how they affect joint mobility and stability." The proprioceptive system and the biomechanical system can work together in one process called proprioceptive neuromuscular facilitation (PNF). PNF underlies the mind-body benefits, being the neuromuscular and musculoskeletal processes, in good vocal training. It can address in one method the physiological processes of a mind-body technique like singing.

A method of Pilates-based physical training is a system of exercises that conditions the mind and the body. It focuses on optimal body alignment and well-coordinated breathing eliciting efficient breath management. The exercises have been shown clinically to strengthen target muscles and increase control, flexibility and coordination in a series of connected movements. The principles and concepts in Pilates-based physical training also emphasize body alignment and breathing with strong mind-body connections as the prime basis for all its exercises. Similar to singing, Pilates-based physical training integrates the two systems of proprioception and biomechanics using neurophysiology and functional anatomy in a multifaceted approach to training by involving the technique.

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7 Houglum, "Chapter 8 The ABCs of Proprioception."
9 Dolly Kelepecz, Creator and Instructor of DK Body Balancing Method, interview by author, University of Nevada, Las Vegas, November 9, 2007.
of PNF. PNF underlies the mind-body benefits of Pilates-based exercises. It can therefore act as a bridge connecting the techniques of singing and Pilates-based exercises.

I maintain that when singers train with the specific Pilates-based exercises that target the muscle groups fundamental to volition and respiration, emphasizing posture and correct breathing with skilled mind-body conditioning, they will better understand the biomechanics and neurophysiology of singing. With the use of Pilates-based models, they will thus be able to better measure and monitor their progress.

Pilates-based physical training can be relevant to how voice teachers and voice pedagogues train singers. For example, if a singing student wants to sing louder\(^\text{12}\) and longer with more intensity,\(^\text{13}\) the student will need to increase strength, stamina and coordination of target muscles involved in breath support\(^\text{14}\) and breath control\(^\text{15}\) in the vocal process. To achieve optimal results singers will also need to define and reeducate the physiological processes in their mind-body conditioning as it relates to correct posture and well-coordinated breathing in singing. The principles of kinesiology when applied to a method of physical exercise can be a diagnostic tool “using manual muscle testing to help identify the primary dysfunction and treating by attempting to correct the underlying state.”\(^\text{16}\) Therefore, an integrated method for training singers with a method of physical training exercises can potentially be used as a diagnostic tool to help identify areas of


\(^{13}\) James McKinney, *The Diagnosis & Correction of Vocal Faults* (Nashville, Tennessee: Broadman Press, 1982), 55. The term intensity as part of breath pressure definition: “Breath pressure contributes to both the pitch and intensity of the vocal tone.”

\(^{14}\) Ibid., 56. The term breath support defined as “a function of the breathing muscles.”

\(^{15}\) Ibid., 56. The term breath control defined as “how long you can sing on one breath.”

weakness with respect to the student's physiological processes. This type of reeducation is further studied and documented by Dr. Robert T. Sataloff in his book *Professional Voice: The Science and Art of Clinical Care*. In the chapter entitled “The Singing Voice” he suggests:

It behooves the singing teacher to acquire special knowledge of posture analysis and muscle conditions. In many cases, it is advisable for the student to include physical exercises to improve posture and strengthen support muscles. Basic principles of posture analysis and exercise programs can be found in the literature, and consultation with a skilled physiatrist or physical therapist may be valuable in selected cases.\(^{17}\)

Pilates-based exercises and PNF techniques are used by physical therapists today.\(^{18}\) It would be advantageous for a singer to use an “integrated method of voice performance training consisting of Pilates-based exercises” (integrated method) as a tool to achieve improved voice performance and to avoid potential overuse injury.

The objectives of this document are to define potential benefits and synergies in the application of a Pilates-based physical training method to versatile and high-level voice performance and to develop an integrated vocal pedagogy-Pilates-based physical training method to improve voice performance. This document will investigate the hypothesis and will derive conclusions that singers trained with Pilates-based exercises, which target the specific muscle groups fundamental to volition and respiration with an emphasis on posture and correct breathing in the vocal process, will develop through PNF, better singing biomechanics, mind-body awareness and conditioning for voice performance training.


CHAPTER 2

RELATED TOPICS FOR PILATES TRAINING IN SINGING

The Importance of Posture, Breath Management, and Mind-body Conditioning in the Techniques of Singing and Pilates

Vocal pedagogues emphasize the topics of posture and breathing coordinated with skilled mind-body connection in the training of volition\(^{19}\) and respiration\(^{20}\) in the vocal process. Voice teachers use breathing exercises and vocal exercises to help improve muscular coordination, muscular endurance and stronger mind-body conditioning in teaching singers. Vocal pedagogues Richard Miller and D. Ralph Appelman propose that breathing is central to singing, and suggest that breath control and its management is a learned technique.\(^{21}\) Miller includes several breath management exercises without phonation (nonphonatory) in his chapter on “The Supported Singing Voice: Breath Management in Singing.”\(^{22}\) He also discusses “prephonatory tuning”\(^{23}\) as a necessary part of the vocal process. Prephonatory tuning is predicated by coordinations in both the

\(^{19}\) Clifton Ware, Basics of Vocal Pedagogy, The Foundations and Process of Singing (New York: McGraw-Hill, 2004), 54. The term volition defined as “(Motivator-physical cause) \(-\) neural pathways \(\{\text{vocal effect}\}) The brain and neurological system sends commands to and receive messages from the body, resulting in muscular responses that control various aspects of the vocal process.”

\(^{20}\) Ibid. The term respiration defined as “(Actuator – Breath energy) The muscles and organs of breathing (trachea, lungs, bronchi, diaphragm, ribs and abdominal and back muscles act in coordination to control the inhalation and emission of air, the fuel for vocal tone.”


\(^{22}\) Ibid., 29–32.

\(^{23}\) B. D. Wyke, “Laryngeal neuromuscular control systems in singing: a review of current concepts,” Folia Phoniatica 26, no. 1 (1984): 296, quoted Miller, The Structure of Singing, 2. The term prephonatory defined as “the position the vocal folds assume before the onset of sound” including the “laryngeal neuromuscular behavior in speech and singing just before the onset of phonation…”
laryngeal and respiratory systems during the inspiratory breath before phonation for efficient closure of the glottis, while also addressing the efficiency in glottal closure.\textsuperscript{24} However, nonphonatory training is inclusive of both prephonatory tuning, and controlled expiration without phonation. With regards to posture, breath management and mind-body conditioning, the variations in neuromuscular function or motor control of the respiratory system for voice performance in phonatory or nonphonatory training compared to regular breathing, is what makes singing students different from nonsinging students.\textsuperscript{25} Volitional and respiratory aspects of prephonatory and nonphonatory training in singing suggest how physical training mind-body techniques can be relevant to the study and practice of singing.

Pilates-based physical training is a mind-body technique that can train to improve and reeducate volitional and respiratory function.\textsuperscript{26} Modern-day Pilates methods are based on a routine of exercises coupled with specific breath patterns that focus on posture and breath management with coordinated mind-body connections.\textsuperscript{27} Pilates-based exercises are based on volitional training of muscles related to improving not only core strength of the torso, but also “spinal and joint mobility, and proprioception, balance and coordination training.”\textsuperscript{28} In the Journal of Voice, authors from the department of otolaryngology\textsuperscript{29} from the University of Rome maintain that posture is not an inherent

\textsuperscript{24} Miller, The Structure of Singing, 5.
\textsuperscript{26} Kristin Smith and Elizabeth Smith, “Integrating Pilates-based Core Strengthening into Older Adult Fitness Programs. Implications for Practice. Topics in Geriatric Rehabilitation” 21, no. 1 (2005): 57.
\textsuperscript{27} Kelepecz, DK Body Balancing Method, 2007, introduction.
\textsuperscript{28} Smith and Smith, “Integrating Pilates-based Core Strengthening.” 57.
\textsuperscript{29} Webster's New World Medical Dictionary, 3rd ed., s.v. “Otolaryngology.” The term otolaryngology defined as “a medical and surgical specialty concerned with the diagnosis, management, and treatment of diseases and disorders of the ear, nose, throat (ENT) and related structures of the head and neck, including the sinuses, larynx (voice box), oral cavity, and upper pharynx (mouth and throat).”
trait and is synergistic with breath management. These learned skills of posture and breath management with coordinated mind-body connections are common to both singing and Pilates. Since specific Pilates-based exercises focus on the related topics of posture and breath management with mind-body conditioning in nonphonatory training for singing, then an integrated method for singers can help improve voice performance training by focusing on the steps of volition and respiration in the vocal process. The anatomical, biomechanical and physiological aspects of volitional and respiratory training of posture and breath management, will be discussed in Chapter 3.

Volition and Respiration in the Vocal Process

The vocal process as described by Clifton Ware can be summarized as five steps: volition, respiration, phonation, resonation, and articulation. This process is the foundation for all styles and levels of singing. The first step, volition, connects the mind to the body which engages the neuromuscular system. Messages are sent and received between the brain and the body. Various sensory information triggers both voluntary and involuntary motor control functions in the vocal process. Respiration, next, engages the respiratory organs and muscles responsible for the coordinations of inspiratory and controlled expiratory breathing. Phonation, resonation and articulation deal with the creation of a tone, the amplification of that tone, and its molding into recognizable speech.

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31 Ware, Basics of Vocal Pedagogy, 54.
33 Ibid.
sounds respectively.\textsuperscript{34} The act of singing involves the entire body and accesses various neuromusculoskeletal systems.

Since volition and respiration are the first two steps in the vocal process, I maintain that they can directly affect the singer’s potential for improvement in phonation, resonation and articulation. Volition is the first step in creating a ripple effect. This idea is illustrated in Figure 1 by a nonlinear ripple theory.

Figure 1. Nonlinear Ripple Theory of the Vocal Process

Vocal Process – 5 Steps

Although the steps of the vocal process are executed in a specific order, once the process is complete, it need not continue in a linear sequence. However, if the initial performance of each step is at its peak level, then the overall potential for optimal singing will be proportionally affected. Therefore, if the first wave of volition is at an optimal performance level, then the resulting wave of respiration will have the potential for an

\textsuperscript{34} Ware, Adventures in Singing, 5–6.

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optimal performance level, and so on. This theory is the basis for discovery of new methods to improve voice performance training. Other mind-body techniques that can enhance volitional and respiratory functions could be integrated with voice pedagogy for enhancing nonphonatory (without phonation) training for singers. One example of a mind-body technique that meets these requirements is a Pilates-based physical training method.

Evidence to Support Importance of Posture and Breathing in Voice Pedagogy

Richard Miller and D. Ralph Appelman maintain that posture and breathing are interrelated. They also propose that breathing is central to singing, and suggest that breath control and its management is a learned technique. William Vennard does not believe that breathing is the most important factor in tone production, but does acknowledge that if breathing can be improved, then singing can also be improved. Although breathing is part of respiration in the vocal process, Clifton Ware explains that correct posture is important because it creates a foundation of body symmetry and spinal alignment for optimal neuromusculoskeletal coordinations involved in the vocal process. According to James C. McKinney, “good posture precedes good breathing.”

Since posture can affect biomechanical and physiological functions in singing, methods to improve posture should be investigated. An article written by voice science experts J. S. Rubin, L. Mathieson and E. Blake on “Posture and Voice” was published in

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36 Miller, The Structure of Singing, 311.
38 Ware, Basics of Vocal Pedagogy, 49.
39 McKinney, The Diagnosis & Correction of Vocal Faults, 57.
the Journal of Singing in 2004. On the National Association of Teachers of Singing (NATS) website, the article was annotated by former NATS president and voice professor John Burgin as follows: “Recently, importance of posture to well being has become popularized through the works of authors such as Alexander, Pilates, Feldenkrais, and others.” The annotation also concludes that a familiarity of new concepts and methods emerging from both traditional and alternative medicine may be valuable to a singer’s training. A related article by Rubin, Mathieson, and Blake, entitled “Musculoskeletal Patterns in Patients with Voice Disorders” was published in 2007 in the Journal of Voice. These articles as well as other supporting literature from the Journal of Singing and the Journal of Voice, suggest that voice pedagogy could consider various mind-body techniques as other methods to enhance voice performance training.

Evidence to Support Posture and Breathing in Voice Science

In the study of voice science, as in voice pedagogy, it is understood that postural alignment is vital to improving voice function. Since postural alignment is not an inherent trait, in order to maintain optimal alignment of the body, the intricate series of muscular coordinations must become habitual. The article on “The Considerations for Maintenance of Postural Alignment for Voice Production” provides supporting evidence and new physiological information for why voice teachers and voice therapists

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41 Ibid.  
42 Ibid.  
44 McKinney, The Diagnosis & Correction of Vocal Faults, 35.
recommend maintaining “optimal postural alignment.” The support is based on a growing understanding of the “physiology behind the relationship between body mechanics and voice” as noted by Wilson. The more we understand the neuromusculoskeletal systems involved in posture and breathing, the more efficient the training can be for students of voice performance. Therefore, it is important to keep up-to-date with new information about the physiological aspects concerning posture and breathing for improved training for voice production.

Studies in voice science are also helping voice pedagogues identify musculoskeletal abnormalities in both the laryngeal and the respiratory systems that can become evident during voice production. Awareness and identification of these vocal dysfunctions by instructors with physical therapy training can help prevent overuse injury leading to healthier voice production. An article in *The Journal of Voice* reports that posture and its synergy with breath management has been established as an important component of vocal performance. With the combined knowledge about posture and breathing from voice pedagogy and voice science, an integrated method should be considered for improved volitional and respiratory training for singers.

**Prephonatory and Nonphonatory Training, Subglottal Air Pressure and Glottal Activity**

Nonphonatory training for singers is used to improve breath management and prephonatory tuning. Nonphonatory breathing exercises involve both the respiratory and

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45 Wilson, “Postural Alignment for Voice Productions,” 98.
46 Ibid.
laryngeal systems. These exercises also address lung volume, breath pressure, subglottal air pressure, and glottal activity. Murray and Caligiuri report differences in “chest wall dynamics” and “vertical laryngeal position” in nonphonatory breath management of singing students versus nonsinging students. Miller includes several “breath management exercises without phonation” as a part of his book, *The Structure of Singing.* He includes one particular exercise reputed to have been used by the famed castrato Farinelli, who was known for his exceptional breath control. Miller includes this exercise in his chapter on “The Supported Singing Voice: Breath Management in Singing” to help singers “train the breath musculature essential to singing without tiring the voice.”

Lung volume is part of the respiratory system. An increase of vital lung capacity and complental breath can improve lung volume in breath management for singing. According to Miller’s *Training Soprano Voices,* fluctuations in airflow can be affected by lung volume and changes in lung pressure. Miller cites distinguished voice scientist Dr. Ingo Titze regarding the rate of breath emission. Titze explains how there are reflexes regulated by the autonomic nervous system that tie “the laryngeal action and the thoracic

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50 Ibid.
51 Miller, *The Structure of Singing,* 29–32.
52 Ibid., 30–31.
53 Ibid., 31.
54 Richard Miller, *Training Soprano Voices* (Oxford: Oxford University Press, 2000), 35. The term vital lung capacity defined as “the capacity of the lung, measured through forced expiration (sudden rapid breath expulsion) following full inspiration.”
55 Ibid. The term complental breath defined as “air that may be taken in addition to tidal breath but requires additional inspiratory activity.” The term tidal breath defined as “consist[ing] of air that can be inhaled and exhaled in quiet breathings;”
56 Ibid.
action… together into a functional unit” in order to maintain a constant airflow rate.\textsuperscript{58}

This expiratory air in singing, referred to by Appelman as breath pressure, is a “steady uninterrupted flow of [air] pressure against the vocal folds.”\textsuperscript{59}

Breath pressure or air pressure below the vocal folds is called subglottal air pressure. According to Appelman’s \textit{The Science of Vocal Pedagogy}, subglottal air pressure is dependent on the thoracic, abdominal and diaphragmatic muscular forces during controlled expiration and is “most effectively utilized when there is no undue tension in the neck and throat.”\textsuperscript{60} Appelman also maintains that a singer can learn to increase or decrease subglottal air pressure with skilled muscular control.\textsuperscript{61}

Changes in subglottal air pressure create varied glottal activity.\textsuperscript{62} According to Appelman, glottal activity (i.e. variations in closure of the glottis) also depends “upon the coordination between the total laryngeal musculature and the breath pressure.”\textsuperscript{63} Miller further supports Appelman by referencing Ladefoged’s “bellows analogy” to explain how the subglottal pressure and glottal activity in a nonphonatory breath management exercise is “equally applicable to a description of the regulation of subglottic pressure and airflow rate in singing.”\textsuperscript{64} Therefore, subglottal air pressure is fundamental to both prephonatory tuning and breath management in voice performance training.

\textsuperscript{59} Appelman, 13.
\textsuperscript{60} Ibid.; Peter Ladefoged, “Sub-glottal activity during speech,” \textit{Proceedings of the fourth International Congress of Phonetics Sciences} (The Hague: Mouton, 1962a), 248, quoted in Miller, \textit{The Structure of Singing}, 22. The “bellows analogy”, Miller describes how the “the pressure of air below the vocal cords [i.e. subglottal pressure]” during a delayed rate of expiration is regulated by “coordination[s] of the muscles of the torso and the larynx.”
\textsuperscript{61} Appelman, 24.
\textsuperscript{62} Ibid.
\textsuperscript{63} Appelman, 73.
\textsuperscript{64} Miller, \textit{The Structure of Singing}, 22.
In *The Basics of Vocal Pedagogy*, Ware describes how “[i]n voice production the primary function of the respiration mechanism is to provide subglottal air pressure which drives vocal-fold vibration.”\(^{65}\) He maintains that “the recoil of the lungs and diaphragm...causes air to flow through the glottis” as a preliminary condition to involve the vocal mechanism for phonation.\(^{66}\) Miller further verifies that there is a rise in subglottal pressure with continued musculature of the inspiratory breath upon phonation in singing or upon controlled expiration in nonphonatory breathing exercises.\(^{67}\) The descriptions by both Ware and Miller support how nonphonatory training for breath management is inclusive of prephonatory tuning and controlled expiration.

Nonphonatory breathing exercises can help improve vocal-fold vibration in singing by addressing subglottal air pressure. The “myoelastic-aerodynamic theory of voice production” as defined by Ware includes breath pressure as a part of phonation.\(^{68}\) The theory for vocal-fold vibration is dependent on a combination of both muscular adjustments or myoelastic characteristics, and breath pressure or aerodynamic characteristics of the vocal folds.\(^{69}\) There is a proportional ratio between the increase in subglottic air pressure and the increase in glottal closure. However, Miller explains that in order “[t]o produce a tone of constant loudness and pitch[,] the subglottic pressure must increase, while the vocal cord tension must decrease in order to keep pitch constant.”\(^{70}\) Phonation necessitates a balance of suspension of the inspiratory and

\(^{65}\) Ware, *Basics of Vocal Pedagogy*, 73.  
\(^{66}\) Ibid., 92.  
\(^{67}\) Miller, *Training Soprano Voices*, 34.  
\(^{68}\) Ware, *Basics of Vocal Pedagogy*, 280.  
\(^{69}\) Ibid.  
expiratory breath musculature while also keeping laryngeal stabilization. Subglottal air pressure and glottal activity in nonphonatory breathing exercises for voice training, similarly involve the laryngeal and respiratory systems to function as a unit in breath management. Therefore, subglottal air pressure variations that influence glottal activity in nonphonatory training, suggest why mind-body techniques that do not use phonation but address the respiratory and laryngeal systems, can still be relevant to the study and practice of singing.

Mind-body Techniques and the Role of Proprioception

Mind-body techniques, also described as “psychophysical” techniques, employ a complicated sequence of events describable both anatomically and conceptually. Proprioception plays a large role in a mind-body technique and involves complex coordinations within the neuromuscular system. It is related to sensation and involves the autonomic nervous system. The autonomic nervous system helps control visceral functions of the body. Although the autonomic nervous system functions primarily at a subconscious level, proprioception can be both conscious and subconscious in its regulation of the neuromuscular system.

Gustav Theodore Fechner established Weber-Fechner's law, which describes methods for the exact measurement of sensation through the study of psychophysics (the relationship between physiology and psychology). Through Fechner’s work,

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71 Appelman, 24.
experimental psychology became an established science. As reported by Appelman, "the law could be applied to a stimulus of any kind – light, vision, taste, touch, and smell." Proprioception or sensation is fundamental in posture and breath management. The importance of proprioception is discussed in Stark's *Bel Canto: A History of Vocal Pedagogy* where he references Gould's description of how proprioceptive control is a contributing factor to the synergistic actions between the voice, respiration and posture for singing.

Vocal pedagogues such as Miller and Appelman have indirectly addressed the importance of proprioception in their exercises and methods that facilitate the development of mind-body control involved in the vocal process. With the growing understanding of the neurophysiological affects on singing, mind-body techniques are considered invaluable for training proprioceptive control.

In the article "Mind-body Workout with Pilates and Alexander Technique," the authors refer to both techniques as tools to help conceptually illustrate the difficult neurophysiological elements in correct postural alignment and breathing. In today's modern Pilates methods, the initial emphasis is on "understanding body symmetry and improving awareness with the mind, connecting breathing, getting the feel of the right muscles working and the over-worked areas being de-stressed." Various types of mind-

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75 Appelman, 154.
body techniques can promote healthy coordinations for reduced physiological stress. 79
This is why MD Anderson’s Integrative Medicine Program for oncologists is reporting on research to evaluate the scientific merit of these various mind-body techniques. 80

An article found in Harvard Women’s Health Watch states “Pilates incorporates mind and body.” 81 Mind-body conditioning in a modern Pilates method allows for advanced conditioning of muscles within the body’s natural symmetry and pain thresholds. 82 The exercises require concentration, working both the body and mind. 83 From a report in the Journal of Sports Rehabilitation, results of muscular training for clients with weaknesses in posture and breath support showed that flexibility and proprioception, being the “two physiological functional performance measures,” increased (i.e., showed improvement) with Pilates training. 84 The growing knowledge and evidence about independent mind-body techniques support cross-training of these different disciplines for optimal results in posture and breath management with skilled mind-body conditioning. 85 This approach has suggested the development of new training models that integrate more than one mind-body technique. Until these integrated models are developed, we can use already established theoretical models of training to help improve proprioception in posture and

80 Ibid.
breath management. 86 One example is proprioceptive neuromuscular facilitation (PNF), which will be discussed in further detail in Chapter 3.

Evidence to Support Importance of Proprioception in Posture and Breathing

Proprioception is fundamental to voice production due to its role in posture and breathing with skilled mind-body coordinations. In order to create a practice to improve proprioceptive control, we need to define proprioception in practical terms. Three integrated areas of focus are considered as a part of proprioception in posture and breathing: sense of body position, movement of the limbs, and sense of muscular tension. 87 Information about the three areas is determined by receptors. One type of receptors are proprioceptors in the joints, tendons and muscles. Other types include vestibular receptors and tactile receptors. For clinical and practical reasons, it is important to know the role that proprioceptors play when addressing posture and breathing in voice production.

The mechanism of how sensory information in the neural system is received from proprioceptors in the tendons and muscles is a subconscious function. 88 However, the information from proprioceptors can be used with conscious repetition of an action. In addition, the consistent feedback response for postural adjustments can become part of the autonomic nervous system as a semi-trained involuntary action. 89 This type of

87 Ibid.
88 Ibid.
89 Lamotte, “Proprioception.”
conditioning with feedback for postural adjustments is advantageous when practicing to learn and habituate correct breathing behavior.

Since correct voice training includes the properly executed repetition of breathing exercises, then inevitably correct breath management can result in good voice production. Optimal voice production mandates that correct prephonatory tuning and correct refilling of the respiratory system must be accomplished. In order to realize this, optimal postural alignment must also be achieved.

Proprioception plays a role in the practice of correct breathing behavior because certain muscle contractions can alter the proprioceptive scheme as it relates to postural alignment. Practiced, correct breathing behavior can help affirm a correct proprioceptive scheme that can result in better voice performance. An article on proprioception explains that “in normal conditions such central feedback enables the nervous system to determine which proprioceptive information resulted from intended movements and which ones came from stimuli externally applied.” The practical applications of improving proprioceptive control in posture and breathing are addressed in a mind-body technique. One such technique is a method of Pilates-based physical training. The method focuses on the functions of proper breath management, optimal alignment of the spine with body symmetry and conditioned mind-body coordinations that become semi-automatic responses. Since proprioception can be addressed in Pilates-based physical training exercises, then its approach to improving posture,

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90 Bruno et al., “Voice Disorders and Posturography,” 74–75
91 Ibid.
92 Ibid.
93 Lamotte, “Proprioception.
breathing and mind-body conditioning would benefit nonphonatory training for voice performance as well.

**Importance of Posture, Breath Management and Mind-body Conditioning in Pilates**

Interest in Pilates is growing as it evolves from mainstream fitness to including rehabilitative and high performance athletic training. It focuses on posture and breathing with skilled mind-body connections and with a lowered risk of injury. The Pilates Method Alliance (PMA) is a not-for-profit organization that represents the regulation of Pilates methods. The PMA describes a Pilates method by how the exercises focus on “postural symmetry, [and] breath control with training the body as a whole.” Its benefits are related to better mind-body conditioning of muscles related to posture and breathing. This is substantiated in *Harvard Women’s Health Watch*, where the component of mind-body conditioning is emphasized as part of an article on “conditioning in Pilates.” It reports that the exercises focus on the deep muscles that are involved in coordinated breathing and correct posture. In a recent publication entitled “the power of Pilates” in *American Fitness*, the authors describe Pilates-based exercises as emphasizing “form over function.” The authors suggest that when specific target goals of postural alignment and breathing patterns with coordinated skilled mind-

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96 “Conditioning by Pilates,” 2.
98 Ibid.
99 “Conditioning by Pilates,” 2.
100 Ibid.
body connections in a Pilates-based exercise program are achieved, they will produce optimal results.101

The mat repertoire and props routines of Pilates-based physical training methods are usually done in supine (lying on back) position on the floor. However, the exercises are aimed at improvement of posture and breath management when in the standing position as well. As substantiated by Joan Breibart in her *Standing Pilates: Strengthen and Tone Your Body Wherever You Are*, many of the exercises can be modified and performed in the upright position.102 This is relevant if an integrated method is to be created for students such as singers who usually practice and perform in a standing or upright position.

**Evidence to Support Importance of Posture, Breath Management, and Mind-body Conditioning in Pilates**

There are supportive testimonials reported in the article, “The Effectiveness of Pilates training in healthy adults: An appraisal of the research literature.”103 Results from studies of Pilates training from the *Journal of Voice* and other physiotherapy journals also have relevant information that can be applied to support the importance of posture and breathing in Pilates training. However, it must also be acknowledged that there is a need


for more sound research with viable methodologies to empirically support the
effectiveness of Pilates training.

In a torso strengthening program for adults, Pilates was used to improve posture and
respiration through “spinal and joint mobility, and proprioception, balance and
coordination training.” The research demonstrated that neuromuscular control was
improved with a focus on core or torso muscles that ultimately improved postural
stability and respiration. The study also affirmed that deep diaphragmatic breathing is
the prescribed breathing style in Pilates.

Aside from just the respiratory training, there is evidence that Pilates also helps
improve volitional training for the muscles in the lower back, pelvic and thoracic
regions. This indicates that Pilates-based exercises are useful for the improvement of
the particular muscles that are involved in postural stability as well as breath
management. This is further substantiated in a study claiming to be the first to
evaluate Pilates as a functional exercise therapy for the lower back, where changes to
improve postural function of the lumbar spine were possible. Proprioceptive control
of the torso during movements of the limbs was also improved. Electromyography
confirmed that muscles for posture and breath management could be activated by using
the coccyx-curl maneuver that is present in the Pilates method. It is reported that
muscle atrophy is not always the cause of weakness in a muscle, but it can actually be
causation by “impaired motor control with decreased proprioception and a decrease in

104 Smith and Smith, “Integrating Pilates-based Core Strengthening,” 57.
105 Ibid., 62.
106 Ibid.
107 Ibid., 66.
108 Ibid.
109 Gladwell et al., “Does a Program of Pilates Improve Chronic Non-Specific Low Back Pain,” 347.
110 Ibid.
111 Ibid., 339.
precision of muscle coordination". In Wendy Green’s review of *The Mind-Body Workout with Pilates and Alexander Technique* she confirms that Pilates-based exercises are an invaluable tool that could be used to teach students the mind-body concepts of posture, breathing and alignment. Therefore, the ability to train mind-body coordinations with Pilates-based exercises for improvement in proprioception, balance and flexibility, helps to improve both posture and breathing.

**Conclusion to Related Topics for Pilates Training in Singing**

The learned skills of posture and breath management with coordinated mind-body connections are common areas to both singing and Pilates. In his Pilates workbook, Allan Menezes reports that opera singers who practiced Pilates by focusing on posture and correct breathing, verified that there were unexpected but encouraging benefits for voice performance. The singers showed dramatically increased strength and stamina in breath control and breath support, as well as improved postural awareness.

There is growing understanding of the physiology behind the relationship between body mechanics and the voice. A mechanistic teacher “uses direct control in exerting physical effort to habituate new mind-body responses.” In order to do this, he or she needs to know and understand the physiological aspects behind the relationship between body mechanics and the voice. Since breathing and posture with mind-body conditioning

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112 Gladwell et al., “Does a Program of Pilates Improve Chronic Non-Specific Low Back Pain,” 347.
115 Ibid.
are part of nonphonatory training, then it can be theorized that an integrated method can be developed by focusing on volition and respiration in the vocal process.

Mind-body conditioning is essential for volition in singing. Volition is regulated by proprioception in posture and in breathing. Therefore proprioceptive neuromuscular facilitation (PNF) that helps improve posture, can also help teachers understand how training should be approached when applying Pilates based-exercises to voice performance training.

This document has shown how important information from various sources including evidence-based medicine by experts in the fields of vocal pedagogy, voice science, and mind-body techniques, supports that there are related topics in Pilates training for singing. In order to create an integrated method, this document will develop a common vocabulary, drawn from kinesiology and neurophysiology, as the integrated method relates to the techniques of singing and Pilates-based physical training.

117 Webster's New World Medical Dictionary, 3rd Ed., MedTerms is the Medical Dictionary of MedicineNet.com authored by WebMD and http://www.medterms.com/script/main/art.asp?article key=33300 (Hoboken, New Jersey: Wiley Publishing Inc.) May 2008. The term Evidence-based medicine defined as “The judicious use of the best current evidence in making decisions about the care of the individual patient. Evidence-based medicine (EBM) is meant to integrate clinical expertise with the best available research evidence and patient values. EBM was initially proposed by Dr. David Sackett and colleagues at McMasters University in Ontario, Canada.”
CHAPTER 3

ANATOMY AND PHYSIOLOGY OF POSTURE
AND BREATH MANAGEMENT

There are three areas that summarize what Miller and Appelman consider essential for optimal performance in the steps of volition and respiration in the vocal process: body alignment (posture) as managed by the central nervous system; balance and coordination with controlled breath management; and agility and muscle flexibility (mind-body conditioning). All three areas can also be addressed in nonphonatory training for the improvement of singing.

Since posture, support and sensations are not easily accessible terms used by vocal pedagogues we cannot go without definitions, explanations and tools for training. When a singing teacher mentions posture, students attempt to stand tall. There are few specific guidelines that help us understand the anatomical, biomechanical and neurophysiological aspects of how to create good posture. The vertebral column, also known as the spine, is a critical component of posture.

Posture with a skilled mind-body connection in singing depends on optimal spinal alignment and body symmetry. Body alignment is managed by a neural system called the central nervous system (CNS) housed in part by the structure of the spine. Knowledge of the anatomy, biomechanics and neurophysiology related to the spine is useful in understanding how singers can improve their training for voice performance.
There are three main components to the spine: the bones and discs of the spinal column, the neural elements, and the supporting muscles and ligaments. The bones of the spine are also called the vertebrae. The vertebrae and the discs help to support and

allow for movement. Many ligaments and muscles attached to the back of the spine (posterior aspect) provide power for movement.\textsuperscript{119} The vertebrae are divided into several sections: seven cervical (C1-C7) vertebrae that exist in the neck area; twelve thoracic (T1-T12) vertebrae in the upper back area; five lumbar (L1-L5) vertebrae in the lower back area; five fused vertebrae in adults that create the sacrum (S1); and three or four fused vertebrae in the tailbone or coccyx (not abbreviated or numbered).\textsuperscript{120} The vertebrae in each section are numbered from the top of the spine to the bottom in sequential order. For example, C7 and T1 would be next to each other in the lower neck and upper back region.

There are two different perspectives of the spine in the upright position. Ideally, in a two-dimensional posterior view of the spine, the spine should be straight and symmetrical. However from the lateral view (Figure 2) there are distinct curves in the spine. These are natural curves that move inward (lordotic) or outward (kyphotic).\textsuperscript{121} The cervical and lumbar sections of the spine are lordotic whereas the thoracic section of the spine is kyphotic. The curves in the spine absorb undue forces from various actions including heavy lifting or jarring movements. Whether in a sitting or standing position, regardless of these various actions, the curvature of the spine allows the head to keep its anatomically ideal position above the pelvis.\textsuperscript{122} The natural curves in the spine minimize stress on the joints that support fluidity and symmetry in the body.

\textsuperscript{119} Rodts, “Your Healthy Spine.”  
\textsuperscript{121} Kelepecz, interview by author, November 9, 2007.  
\textsuperscript{122} Rodts, “Your Healthy Spine.”
The CNS consists of the brain and the spinal cord. The spinal cord consists of nerves. It originates at the brain and then runs inside the center of the vertebral column to the bottom of the tailbone. At the tailbone the nerve ending frays into several root ends. The neural aspects of the spinal cord and nerve roots that are part of each vertebra play an important role in mind-body connections and proprioceptive control, since each nerve in the nervous system is designated to a certain muscle in the body. These particular muscles may also be fed sensory information because of proprioceptive characteristics associated with them.

The component of muscles and ligaments connected to the spine are crucial in supporting the structure of the spine. They allow for a range of mobility in the torso or trunk of the body. There are important muscles for posture and breathing that originate or insert into the back or posterior part of the spine. The spine becomes the anatomical foundation for understanding how biomechanical and neurophysiological functions in posture and breathing make it necessary to integrate a skilled mind-body connection for optimal results. The spine is the important basis for alignment and symmetry of the body.

Posture in Singing

Biomechanically, certain anatomical structures and organs have a significant impact on posture. This is especially true in singing. For example, the thoracic cage is a very

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124 Rodts, “Your Healthy Spine.”
125 Kelepecz, interview by author, November 9, 2007.
important structure that is involved in all functions of volition and respiration in the vocal
process.

The thoracic cage consists of the sternum, ribs and vertebrae. The sternum or
breastbone is a large flat bone located in the center of the chest. The position of the
sternum is reflected in the body’s carriage by its association with the ribs and the
vertebral column. The sternum is important as a support for the ribs. There are twelve
ribs in total that make up the ribcage. All the ribs are directly connected to the spine.
The upper seven ribs in the thoracic cage are also attached to the sternum. Ribs eight,
nine and ten are attached by cartilage to the seventh rib. The lowest eleventh and twelfth
ribs only attach to the spinal vertebrae at the back of the thoracic cage.

The thoracic cage and its role in posture are dependent on the functions in respiration.
The function of the lungs as a main respiratory organ directly affects posture. The shape
of the lungs is maintained by the position of the ribs, sternum and vertebrae and the
action of the muscles that support its movement.\textsuperscript{126} Therefore, the thoracic cage and its
muscles can affect the amount of air inhaled or exhaled during respiration. The spine
adjusts to the expansion and contraction of the lungs by lengthening or shortening in
response to the actions of the ribs and the sternum. The lung volume\textsuperscript{127} is therefore
dependent on the entire action of the thoracic cage.

Miller describes a specific target goal for posture upon renewal of breath in singing.
In the first cycle of breathing, if the sternum stays up and out, then there is no need for a

\textsuperscript{126} Miller, \textit{The Structure of Singing}, 267–269.
\textsuperscript{127} Sataloff, \textit{Voice Science}, 275. The term ‘lung volume’ defined as “volume contained in the subglottic
air system; after a maximum inhalation following a maximum exhalation the lung volume equals the vital
lung capacity.”
singer to change posture. In singing or nonphonatory training for singers, this is possible when the expansion of the ribcage from the inspiratory breath is sustained on phonation or in controlled expiration. As a result, both the chest and the sternum keep its inspiratory breath position. This position of the thoracic cage is a result of the lungs being pushed up into the chest cavity during the expiratory breath. There are other muscles and structures that help to maintain this postural target goal for singing. For example, the muscles of the neck are also important for posture in singing.

The muscles of the neck connect to the upper torso. The sternocleidomastoid muscles (SCM) are an example of one pair of muscles that run from behind the ear to the end of the collar bone and attach into the thoracic cage at the sternum. Miller describes how these muscles “provide essential postural support between the head and the torso.” They also act as muscular support columns protecting the larynx and its related muscles. According to The Concise Book of Muscles “the SCM is also equipped with sensory supply for proprioception from cervical nerves C2 and C3.” The SCM has proprioceptive characteristics, so if singers improperly align the spine between the head, neck and thoracic cage, they could hinder both the laryngeal and the respiratory operations of singing. Optimal singing is therefore dependent on correct body alignment.

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128 Miller, The Structure of Singing, 265.
129 Ibid., 20.
130 Miller, The Structure of Singing, 269.
131 Ibid., 271.
132 Ibid.
133 Jarmey, Concise Book of Muscles, 41.
134 Miller, The Structure of Singing, 270–271.
There is another group of bone and muscles located in the upper torso or thorax called the shoulder girdle.\textsuperscript{135} The larger bones of the shoulder girdle involve the clavicles and scapulae. Articulations of these structures include the sternum and the ribs.\textsuperscript{136} The trapezius and the latissimus dorsi both play important roles in posture during respiration in singing. The trapezius muscles connect muscles from the shoulder and back from the spine to the sides of the neck. Like the SCM, they also help support the neck and the shoulders and help keep the spine aligned. The latissimus dorsi are primary muscles that are a part of the enveloping layer over the shoulder girdle, and help keep the ribcage expanded upon inspiration as well as expiration in the vocal process. This expansion helps sustain a lengthened spine during the complete breath cycle. This postural variance inevitably dictates that a new movement pattern of the spine must be established for optimal singing. The spinal column keeps its alignment as a result of the latissimus dorsi working in tandem with other muscle groups including the abdominal muscles in the torso.

The abdominal wall below the sternum has nine chief regions including three front and three lateral planes.\textsuperscript{137} The abdominal front planes include the major flexor and lower trunk abdominal muscles that cross each other and create support in the lower thorax and pelvis without the help of any bone structure.\textsuperscript{138} These muscles are supported by the neuromuscular system, are dependant on optimal alignment of the spine for efficient

\textsuperscript{135} Miller, The Structure of Singing, 273
\textsuperscript{136} Barry Berg, "The Shoulder Girdle," State University of New York Health Science Center and Syracuse, http://www.upstate.edu/cdb/grossanat/limbs3.shtml (accessed November 24, 2007, 3:05:52 PM). The term shoulder girdle defined as "shoulder girdle or pectoral girdle consists of articulations between the clavicle, scapula and the proximal end of the humerus. Extrinsic - Suspend scapula from the trunk. Stabilize and/or actively moves scapula."
\textsuperscript{137} Miller, The Structure of Singing, 10.
\textsuperscript{138} Ibid., 28, 74.
performance of the proprioceptive system. This is an example where the neural elements of the spine are important in the efficiency of coordinating proprioceptive muscles.

As the name suggests, the transversus abdominis (TrA) abdominal muscles have fibers that run horizontally under the internal obliques. The TrA is an important abdominal constrictor (shortened muscle contractions) that runs from the upper thoracic region down to the pelvic area.\(^{139}\) These muscles aid in structural support for posture with increased strength and stamina. The rectus abdominis abdominal muscles differ from the previous TrA abdominal muscles in that its fibers run vertically in the front of the abdominal wall. They are attached to the front of the fifth, sixth and seventh costal cartilages of the ribs, and in the back to the pelvis. The rectus abdominis creates good support for posture in the thoracic region.

Ware suggests that “correct alignment of the body is extremely important in setting up the right conditions for coordinating the vocal process.”\(^ {140}\) As mentioned before, misalignment of the upper or lower body, or asymmetry during the vocal process would negatively affect a singer’s improvement. Since good posture is addressed in the vocal literature as being interrelated to correct breathing, it is therefore inevitable that they share anatomical and physiological traits. Training for proper posture can contribute to improvement in correct breathing.

**Breathing for Singing**

Ware, Vennard and McKinney agree that certain postural conditions must exist before breath management performance can be addressed. Ware suggests that the traits shared in both posture and breathing can be described with a mechanistic approach to vocal

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\(^{139}\) Miller, *The Structure of Singing*, 277.

\(^{140}\) Ware, *Basics of Vocal Pedagogy*, 49.

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pedagogy through voice science. He also cites from the book, *Dynamics of the Singing Voice*, further corroborating that knowledge about the anatomical, biomechanical and physiological aspects in the vocal process, most specifically respiration, is beneficial to both the teacher and student of voice performance.

Natural breathing usually consists of only three stages: breath in, breath out, resting or recovery. However, in breathing for singing, there are four stages: a breathing in period (inhalation or inspiratory breath); setting up controls period (suspension); a controlled exhalation period (or phonation); and a recovery period. In natural breathing the tidal breath is “air which is inhaled and exhaled in quiet breathing.” In the third stage of the exhalation period, if phonation is not present then it is described as a controlled forced expiration or the delayed rate of expiration. Forced breathing is “breathing in which effort is made to inhale and exhale as much air as possible each time.” Miller describes how the “the musculature of the thoracic cage, together with the abdominal musculature, can be coordinated so as to retard or accelerate reflex expiratory action.” The subglottic pressure during expiration with or without phonation is inevitable due to the combined coordination between the larynx and the thoracic musculature. Therefore, the term “controlled forced expiration” can be used to more accurately describe the type of expiration for singers when practicing without phonation.

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141 Ware, *Basics of Vocal Pedagogy*, 52–53.
144 McKinney, 51.; and Ware, *Basics of Vocal Pedagogy*, 78.
145 Vennard, 244.
146 Miller, *The Structure of Singing*, 279.
147 Vennard, 244.
Forced expiration is a pulmonary function that allows one to test for normal and abnormal states of respiratory function.\(^{149}\) This function is based on the expulsion of air in an expiratory breath after having taken in a complete inspiratory breath to total lung capacity.\(^{150}\) In singing, if the biomechanical goals of well-coordinated and correct breathing are achieved, then the procedure of forced expiration can be controlled. For example, if the thoracic cage stays expanded during the expiratory breath and renewal of the breath in singing, then a controlled forced expiration is possible. Controlled forced expiration is usually accompanied by pursed lips that create a resistance in pressure to the exhaled air and can create varied activity of the glottis. Controlled forced expiration mirrors similar biomechanical, physiological and neurophysiological functions in phonation.\(^{151}\) It thereby acknowledges that nonphonatory training as part of singing training can be relevant.

Ware acknowledges that “although breathing is, for most purposes, a subconscious (autonomic) function, we are [still] able to exercise some degree of voluntary control.”\(^{152}\) Therefore with this conscious feature in respiration, it is possible to learn a different way to breathe from everyday breathing. However, the correct way to breathe for singing means reeducating the mind-body coordinations of natural breathing. Ware mentions that “highly trained vocal athletes must develop by necessity efficient and coordinated respiration skills.”\(^{153}\) I believe that any student training in voice performance can achieve


\(^{150}\) Ibid.

\(^{151}\) Miller, The Structure of Singing, 31.

\(^{152}\) Ware, Basics of Vocal Pedagogy, 73.

\(^{153}\) Ibid.
optimal mind-body coordinations of certain respiratory skills with the proper tools for training.

Appelman suggests that singers should relate sensation experience to certain steps in the vocal process. He describes that the “total body is involved in the singing process and that each bodily force depends upon the others in the complex act of supporting the laryngeal sound.” In order to further understand the complex coordinations and connections between the biomechanical and neurological aspects in singing, knowledge about anatomy and objectives related to breathing should be identified.

Both Miller and Appelman discuss significant information regarding the anatomy and objectives of breathing in singing. Balance and coordination with controlled breath management is one of the three areas that Miller and Appelman consider integral for optimal performance in the steps of volition and respiration in the vocal process.

Breath management in vocal pedagogy is described by Miller as, “a learned technique of breath control for singing which permits efficient handling of the breath cycle.” Even in nonphonatory training a complete breath cycle can be used when training singers for improved voice performance by strengthening volition and respiration. A deep inspiratory breath, while meeting objectives as stated by Miller and Appelman, can set the preconditions for an optimal performance of the suspension phase. The breath cycle is completed in nonphonatory singing by focusing on the controlled forced expiration in place of phonation.

It has already been substantiated by Miller and Appelman that breathing is central to the vocal process and as a result, volition must first initiate respiration before continuing.

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154 Appelman, 9.
155 Miller, The Structure of Singing, 311.
156 Ibid., 20.
to stay engaged for the duration of the breath cycle. Miller and Appelman suggest that
the function of the laryngeal structure is a complex human respiratory-phonatory (breath-
tone) mechanism that needs a consistent supply of air in order to make sound. \(^{157}\) Correct
breathing for singers is based on learning proper breath management for singing. Just as
Miller suggests, "breath management is the essential foundation for all skillful
vocalism."\(^{158}\) In order to control forced expiration, posture and body mechanics must be
considered. Both Miller and Appelman address the anatomy and its objectives for correct
breathing and breath support.

Miller's *The Structure of Singing* describes in detail the structure and mechanics of the
breath apparatus. A singer's understanding of general anatomy helps the student interpret
certain sensations in the body. It also creates a consistent vocabulary for singers
describing functions anatomically versus conceptually. Miller highlights his anatomy for
breathing into ten parts: thoracic cage, lungs, sternum (breastbone), the intercostal
muscles, diaphragm, shoulder girdle, latissimus dorsi, lower thorax, abdominal muscles:
transversus abdominis and obliques, and pelvis.\(^{159}\)

The thoracic cage was described in detail as it relates to posture. Both posture and
breathing are interrelated since they both reference the thoracic cage and lungs. However,
the lungs become the focus for breathing. The lungs are the organ that references the
muscles and structures associated with breathing. The lungs are the only major organ
supplying air to the larynx and the vocal cords. There are important respiratory structures
and muscles that are responsible for making sure the lungs receive and deliver the most

\(^{157}\) Appelman, 10.
\(^{158}\) Miller, *Training Soprano Voices*, 32.
\(^{159}\) Miller, *The Structure of Singing*, 259–279.
efficient amount of air needed for this function. Miller suggests that when singers breathe, they need to take in a deep inspiratory breath.\textsuperscript{160} It can establish efficient vital lung capacity, opposed to tidal breathing, for optimal voice performance.\textsuperscript{161}

According to Miller, because the sternum supports the first seven ribs, its position to the spine is essential in the systems of breath management and vocal instruction.\textsuperscript{162} The individual ribs attached to the sternum, expand and contract with each other upon inspiration and expiration respectively. This movement in the ribs creates more room for the lungs in the thoracic cage, thereby increasing its ability to expand upon inspiration.

There are two categories of intercostals muscles in between the ribs that are primarily responsible for this action.\textsuperscript{163} The external intercostals and the intercartilaginous intercostals actively raise the ribs upon inspiration; and the interosseus internal intercostals depress the ribs.\textsuperscript{164} The last of these internal muscles are the deepest of the three.\textsuperscript{165} Another important muscle that initiates movement of the ribs is the diaphragm.

The action of the diaphragm is fundamental to the entire breath cycle. It is the most important muscle involved in the inspiratory breath, since it can account for up to an eighty percent increase in volume of air.\textsuperscript{166} The diaphragm divides the thoracic cavity from the abdominal cavity as well as the respiratory organs from the digestive organs respectively.\textsuperscript{167} It is a dome-shaped muscle that cannot be felt and is not highly

\begin{itemize}
\item \textsuperscript{160} Miller, \textit{The Structure of Singing}, 20.
\item \textsuperscript{161} Miller, \textit{Training Soprano Voices}, 35.
\item \textsuperscript{162} Miller, \textit{The Structure of Singing}, 250.
\item \textsuperscript{163} Ibid., 262.
\item \textsuperscript{164} Ibid.
\item \textsuperscript{165} Ibid., 259.
\item \textsuperscript{166} Ware, \textit{Basics of Vocal Pedagogy}, 78.
\item \textsuperscript{167} "Diaphragm," The Centre for Cancer Education, University of Newcastle upon Tyne, http://cancerweb.ncl.ac.uk/cgi-bin/omd?query=diaphragm (accessed November 20, 2007).
\end{itemize}
proprioceptive; however it is a primary muscle in the function of respiration and also controlled breathing and breath management. The diaphragm originates at the posterior side of the bottom of the sternum, also connecting to the lowest six ribs and L1 to L3 of the lumbar vertebrae.\textsuperscript{168} As explained by Miller, the diaphragm’s central tendon has a fixed point for action in its function with the abdominal viscera. It helps raise the lower ribs, allowing the sternum to push forward from the expansion in the upper ribs.

McKinney maintains that the diaphragm is “the primary muscle for bringing air into the body.”\textsuperscript{169} Similarly, Miller describes that “in deep inspiration, as in preparation for singing, the diaphragm, and the thoracic and abdominal muscles increase their activity.”\textsuperscript{170} Upon contraction, the diaphragm begins to flatten, creating room above for the expansion of the lungs. Controlling the rate of the expiratory breath as measured by diaphragmatic movement back into its resting position, is a necessary skill in good singing.\textsuperscript{171} In addition to the diaphragm and the abdominals, there are also muscles in the structure of the shoulder girdle that are essential to the movement of the thoracic cage.

According to Miller, the muscles in the shoulder girdle that control the breath cycle in singing are the trapezius and the latissimus dorsi. These muscles associated with the shoulder girdle are important in breath management just as they were for posture. However, the trapezius muscles are still primarily used for the postural support they provide for correct breathing. The most important muscles in the shoulder girdle that need to be reeducated for breath management in the vocal process are the latissimus dorsi. The latissimus dorsi are necessary for keeping the ribcage from collapsing upon

\textsuperscript{168} Janney, 53.
\textsuperscript{169} McKinney, 50.
\textsuperscript{170} Ibid.
\textsuperscript{171} Ibid., 24.
expiration of the breath during phonation in singing or controlled forced expiration in nonphonatory training for singing. This active eccentric (lengthening) contraction of the latissimus dorsi during expiration can be learned for singing. In normal breathing, the eccentric contraction of the latissimus dorsi usually occurs upon inspiration.

Monitoring specific target goals such as the position of the sternum or awareness of body tension can assist in training for the function of the latissimus dorsi during controlled forced expiration. Since the shoulder girdle is associated with the muscles of the head and neck, if there is tension or lack of fluidity in the motion within those areas, then breath management can be negatively affected. This is also true if the movement of the sternum is restricted in any way. In order for the muscles of the upper torso to work at its highest level of efficiency, there also needs to be well-coordinated support from the lower part of the torso and pelvis. The upper and lower abdominal muscles play an important role by working in tandem with the upper torso muscles and structures.

Overall, movements of the abdominal wall are initiated by the respiratory organs and the muscles of the torso that control respiration. In singing, the abdominal muscles are especially responsive to the elasticity of the lungs. The appoggio method of breath management described by Miller "maintains for longer periods of time the natural inspiratory antagonism among the muscles of the abdominal wall." He also claims that the deeper the inspiratory breath, the more involvement of the abdominal musculature in

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172 Miller, The Structure of Singing, 274.
174 Miller, The Structure of Singing, 23. The term appoggio defined as "a system for combining and balancing muscles and organs of the trunk and neck, controlling their relationships to the supraglottal [above the glottis] resonators, so that no exaggerated function of any one of them upsets the whole."; Ibid., 24. The term appoggio defined 'practically' as, "[in] appoggio technique, the sternum must initially find a moderately high position; this position is then retained throughout the inspiration-expiration cycle."
175 Miller, Training Soprano Voices, 39.
the expiratory breath.\textsuperscript{176} Also, on the forced expiratory breath, the ribcage and sternum push up and out respectively creating pressure in the chest, thereby activating the abdominal muscles.\textsuperscript{177} The function of the muscles counter the pressure in the chest that is a result of the extra force from the diaphragm’s movement. The lower abdominal muscles that also work in association with the upper torso are associated with the bony structure of the pelvic girdle. These abdominal muscles are located on the lateral plane of the lower abdominal wall.

The three lateral planes of the abdominals include three kinds of flat abdominal muscles.\textsuperscript{178} The first two types are surface muscles called the external obliques and the internal obliques. The obliques are associated with the lower back and spine, and are directly connected to the pelvic girdle\textsuperscript{179} and the ribs. The internal obliques sit under the external obliques and their fibers run into the lower ribs and into rib cartilage. These muscles are fundamental for general posture by supporting the abdominal organs during all movements of the body including breathing for singing. They are also functional in twisting or rotating of the trunk area.

The third type of lateral abdominal muscles is called the transversus abdominis. They are the deepest muscle group imbedded in the abdominal structure. These muscles, like the obliques, also support the abdominal viscera. The TrA is a primary muscle group not only for good posture, but more importantly, for controlled forced expiration.\textsuperscript{180} Miller suggests how the thoracic cage and abdominal wall, in addition to the TrA, should work

\begin{footnotesize}
\textsuperscript{176} Miller, \textit{Training Soprano Voices}, 39.
\textsuperscript{177} Miller, \textit{The Structure of Singing}, 265, 23–24, 30.
\textsuperscript{178} Ibid., 10.
\textsuperscript{179} Ware, 74. The term pelvis or pelvic girdle defined as “sits at the base of the spine in the lower thorax. The sacrum and coccyx (or tailbone) makes up part of the pelvis. This is the lowest part of the vertebral column.”
\textsuperscript{180} Jarmey, 57.
\end{footnotesize
together to vacate the air in the lungs during expiration in the vocal process.\textsuperscript{181} The abdominals are therefore critical in how they coordinate the functions between the upper body and lower body for breathing in singing.

In summary, the breathing apparatus described by Miller includes the muscles and bones of the head, neck and thoracic cage down to the pelvis, which are all fundamental in an efficient breath cycle for singing. Nonphonatory training addresses these anatomical areas as necessary for improving the performance of volition and respiration in the vocal process. Once the structures and mechanics are generally discussed, then more specific objectives for breathing can be identified.

Miller uses the previous highlighted structures of the breathing apparatus as his basis for defining objectives in breath management. His objectives are summarized in two main points. The first point suggests that with optimal alignment and balance of the body, the CNS can maintain a coordinated sequence of events from the inspiratory breath in singing to the delayed rate of expiration upon vocalizing.\textsuperscript{182} Miller’s second point is that muscle contraction must be powerful and flexible for optimal performance in respiration for singing.\textsuperscript{183}

The breath cycle is a learned technique for singers since it is slower in singing than in other normal activities.\textsuperscript{184} Miller’s explanation of breath control states that a singer cannot allow the ribcage to collapse upon expiration, and that resisting the natural reflex

\begin{footnotesize}
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\item[\textsuperscript{183}] Miller, \textit{The Structure of Singing}, 39.
\item[\textsuperscript{184}] Ibid., 265.
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\end{footnotesize}
of the thoracic cage, is imperative for improvement. Resisting a natural reflex is possible when reeducation of the latissimus dorsi is achieved during controlled forced expiration is achieved.

Learned techniques are required by the singer when coordinating respiratory and phonatory mechanisms. In order to achieve a constant pitch and intensity, there must be a constant ratio of airflow between the related mechanisms. Controlled forced expiration also necessitates the need for a constant airflow and is reflected by the inspiratory and expiratory muscles that need to continually adjust to the demands of the changing lung volume. Miller claims that the complexity of this process can only be coordinated by the central nervous system (CNS).

For example, Miller cites evidence that "the most active muscles of the abdomen on the controlled forced expiratory breath are the external obliques, where these muscles characteristically also shows contraction immediately before the production of sound..." In order to have an efficient breath cycle for singing, the external obliques must therefore contract at the end of the inspiratory breath, and just before phonation (i.e. before the controlled expiratory breath). The external obliques once contracted, inevitably trigger the internal obliques to also work in conjunction with the ribs in relation to the spine. Both rotational and lateral movements can be included in this coordination. The CNS is the structure responsible for the volitional training of this complex coordination with controlled breathing.

185 Miller, *The Structure of Singing*, 278.
186 Kelepecz, interview by author, November 20, 2008.
The CNS works by sending and receiving messages to and from the brain to the body monitoring balance, coordination and agility.\textsuperscript{190} This information is valuable in how singers can reeducate and improve volition for respiration in singing with a neurophysiological approach. The intricate functions of breath support are described by Miller in the \textit{appoggio} technique.\textsuperscript{191} The \textit{appoggio} technique addresses the complex coordinations of the muscles and organs involved in the upper and middle thoracic area for overall breath management in singing.\textsuperscript{192} Good posture is needed to achieve the technique of \textit{appoggio}. Although this technique addresses the entire vocal process, it also supports the nonphonatory aspects of singing. In Miller’s \textit{Training Soprano Voices}, he explains that “[t]he term breath energy refers to the results of \textit{appoggio} coordination.”\textsuperscript{193} Thus Miller uses prephonatory tuning and nonphonatory breathing exercises to help achieve and improve this technique.

In an attempt to conceptualize breath support with the \textit{appoggio} technique, Miller explains that there is a level of imagination needed. The student needs to have awareness with respect to the entire body including involvement of the laryngeal mechanism. The CNS can monitor the integration of support within the torso, and as Miller reports, the “powerful abdominal musculature [that] under girds the breath mechanism.”\textsuperscript{194} An understanding of certain biomechanical functions in the body can only be conceptually controlled by volitional training. There is still a need to find a way to best describe a

\textsuperscript{190} Miller, \textit{The Structure of Singing}, 279.
\textsuperscript{191} Ibid., 311. The term \textit{appoggio} defined as “the establishment of dynamic balance between the inspiratory, phonatory, and resonatory systems in singing.”; Miller, \textit{Training Soprano Voices}, 32. The term \textit{appoggio} defined as “[t]he internationally recognized \textit{appoggio} (from \textit{appoggiare}, to lean against, to be in contact with) is a form of breath-management coordination that must be learned if the singer is to unite energy and freedom for successfully meeting the tasks of professional vocalism. The term breath energy refers to the results of \textit{appoggio} coordination.”
\textsuperscript{192} Ibid., 23 or Miller, \textit{Training Soprano Voices}, 32.
\textsuperscript{193} Miller, \textit{Training Soprano Voices}, 32.
\textsuperscript{194} Miller, \textit{The Structure of Singing}, 24.
coordinated sequence of biomechanical as well as neurophysiological actions that dictates the actual process of singing. Further understanding of the CNS is necessary in order to discover ways to support how certain sequential physiological coordinations are possible in the vocal process.

Once balance and coordination are achieved physiologically in training and in performance, then agility becomes important. Agility is an advanced skill dependent on balance and coordination and built on strength and flexibility. It helps improve the mechanics of breathing since it deals with the minute and continual adjusting between muscle tension and relaxation. Therefore static muscle contractions could restrict potential development of agility and the ability to improve vocal stamina and resonance. Optimal voice performance demands that muscle contractions as coordinated by the CNS and maintained physiologically, have to be both powerful and flexible. The CNS is therefore integral to the complex training of agility.

Miller’s description of the anatomy and discussion of the objectives on breath management provide valuable information for the mechanistic voice teacher regarding the overall vocal process. Another expert pedagogue who supports a similar approach to the study and practice of singing is D. Ralph Appelman. Appelman’s views on singing and breathing highlight the use of specific phrases used in vocal pedagogy. He draws attention to the use of “the intercostal lift, the abdominal tuck, and the feeling of support [as] terms that are deeply imbedded in professional terminology and must be investigated

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196 Miller, The Structure of Singing, 41.; and Appelman, 32.
during the vocal process of singing."¹⁹⁷ Despite these terms, knowledge of the human anatomy alone is not enough to describe the vocal process. He further supports that certain terms like “lift ‘tuck” and “support” should be understood as functions addressed in biomechanics and neurophysiology.¹⁹⁸

Like Miller, Appelman describes the anatomy and objectives of breathing and breath management for singing. In his book The Science of Vocal Pedagogy, Theory and Application, Appelman gives a detailed description of the anatomical structures for breathing. Appelman’s list of anatomical structures include the lungs, framework of the thorax focusing on the sternum and ribs, muscles of inspiration, muscles of expiration, and the muscles of the neck.¹⁹⁹ Muscles of inspiration are the rib-raisers: abdominal and pelvic diaphragms; pectoralis major and pectoralis minor; levatores costerum; and latissimus dorsi.²⁰⁰ The muscles of inspiration help the ribs to expand during the inspiratory phase of the breath cycle. Appelman also addresses some other shoulder girdle related muscles such as the pectoralis major and minor. These muscles are usually engaged in passive contraction on the inspiratory breath. Therefore they do not take an active role like the latissimus dorsi in breathing for singing. Unlike the levatores costerum which run the length of the back, the latissimus dorsi sit in the lower part of the thorax. Similar to Miller’s description, Appelman explains that the function of both sets of muscles help to keep the ribcage expanded upon controlled expiration.

The rib-depressors consist of various back muscles. The serratus posterior inferior are upper back muscles at the ninth rib connecting the thoracic and lumbar regions; and the

¹⁹⁷ Appelman, 10.
¹⁹⁸ Ibid.
¹⁹⁹ Ibid., 25–40.
²⁰⁰ Ibid., 35–36.
quadratus lumborum are the deep large back muscles that stabilize the pelvis. Upon inspiration the rib depressor muscles in the mid to lower back create an opposing force to the 'rib raiser' muscles in their upward pulling motion. The opposing forces create expansion horizontally across the body as well as a vertical lengthening mainly in the torso area.

The muscles of expiration are listed by Appelman as the rectus abdominus, transverse abdominis, external obliques, internal obliques, tranverse thoracis, and the latissimus dorsi. Appelman claims that there seems to be simultaneous action of the muscles of the expiratory breath and of phonation. He describes how in controlled forced expiration or phonation, the latissimus dorsi and the abdominal muscles can create a sphincter-like action. In natural expiration the latissimus dorsi is an “antagonist” muscle. In the sphincter-like action, the latissimus dorsi becomes an “agonist” muscle during expiration in singing. The rib depressor muscles also aid in controlled expiration while singing. These anatomical descriptions above help convey the biomechanical and neuromuscular functions of breath management or respiration in the vocal process.

Following his discussion of breathing for singers, Appelman addresses support in singing. In order to clarify the commonly used phrase “singing on the breath,” he describes four objectives that should be met in breath support. His first objective is balance and coordination in the body requiring a fluid but supportive body alignment and

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201 Kelepecz, interview by author, November 20, 2008.
202 Appelman, 37-40.
203 Ibid., 11.
204 Ibid., 40.
205 Jarmey, 31. The term antagonist defined as “the muscle on the opposite side of a joint to the prime mover (Agonist), and which must relax to allow the prime mover to contract.”
206 Ibid. The term agonist defined as “a prime mover is a muscle that contract to produce a specified movement.”
207 Appelman, 11.
structure. The second objective is the necessary physical work by the strong muscles involved with singing for strength and stamina. The third objective entails the vital lung capacity and controlled breath management considering flexibility of the thoracic cage and the stamina of its related muscles. The final objective affirms that a fluid body having flexibility in the muscles is needed so that static muscle contractions do not promote tension, especially in consideration of the neck.

When comparing descriptions of breathing and breath support for singing, Miller and Appelman describe similar structures and functions for respiration in the vocal process. Appelman’s descriptions of the anatomy are specific to what structures are associated with certain points of coordination in the breath cycle of a singer. The agreed upon variations in breathing for singing as opposed to natural breathing as stated by Miller and Appelman, are also vital in determining what exercises are necessary to train with for improved volition and respiration in the vocal process.

Regarding training to improve singing, all aspects of the body’s functions should be considered. This is supported by an article in the *Journal of Voice* maintaining that students and teachers should understand the entire body and its related musculoskeletal systems rather than just identifying discrete structures of the voice like the larynx. There are various musculoskeletal abnormalities, usually found in the neck area that can lead to voice disorders. Authors Rubin, Mathieson and Blake claim that physiotherapy-type rehabilitation proved helpful in the evaluation and management of a group of patients with voice disorders due to musculoskeletal abnormalities. Pilates-based exercises are already used in certain physical therapy practices. In order to

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209 Rubin, Mathieson and Blake, “Musculoskeletal Patterns in Patients with Voice Disorders,” 477.
210 Ibid.
determine if a Pilates-based physical training method can help improve training for volition and respiration in the vocal process, a review and understanding of its principles and concepts as they relate to the anatomy, biomechanics and neurophysiology of breath control and breath support in singing is necessary.

Allan Menezes suggests that singers could cross-train with an integrated method with Pilates-based exercises to help improve their breath management. As reported in his Pilates workbook:

[O]pera singers who practiced Pilates...showed dramatic signs of increased abdominal control and lung capacity. When they focused on breathing into their upper back and armpits the singers could hold notes for longer periods and use their abdominal support for improved voice projection.211

Brief History on the Development of the Pilates Method.

Important Information Related to Posture and Breathing in Pilates

Pilates originated with its creator, Joseph Pilates, after whom the method is named. The first Pilates instructors trained in the United States with Joseph Pilates in the late 1930s. These first generation teachers taught the traditional Pilates method via their own interpretations of the governing principles. Over the last several decades, the method eventually branched off into a variety of teaching styles from traditional to modern. Modern methods of Pilates are based on the same governing principles of traditional Pilates, but integrate modifications that are supported by current knowledge or experience by the instructor from other mind-body techniques, medicine or physical therapy.

Joseph Hubertus Pilates coined the term Contrology for his series of exercises that integrated both mental and physical ideas. Initially his passion for fitness grew out of his

211 Menezes, 26.
personal desire for better health.\textsuperscript{212} Joseph Pilates suffered from asthma, rickets, and rheumatic fever as a young boy. Son of a gymnast father and a naturopath mother, by the age of fourteen, Pilates was versed in yoga, martial arts and anatomy. He studied physical regimens from both eastern and western philosophies, and modeled his physique after the "classical Greek ideal of man who is balanced equally in body, mind and spirit."\textsuperscript{213}

Joseph Pilates worked as a nurse in an internment camp during world war one (WWI) which became the setting for what inspired him to create a new type of fitness. He helped those who were bed ridden and trying to recover from debilitating injuries. His new fitness program was based on resistance training. He utilized the bed springs of immobile patients, creating unique exercises that helped reduce muscle atrophy during the period of recovery. Pilates created a series of exercises that coordinated both the mind and the body in a predetermined sequence of movements. The success of each exercise was determined by certain target goals, and the level was determined by the number of repetitions that could be performed without fatigue. This new fitness regimen was a revolutionary mind-body technique in the early 20\textsuperscript{th} century.

Joseph Pilates dedicated himself for many years to the study of psychophysics.\textsuperscript{214} He thought that neither the body nor the mind should reign over the other. His philosophy was based on the idea that since the mind has limitless functions while the body has its limitations, it would be best to find ways to coordinate them so that they are always at

\textsuperscript{212} Joseph Hubertus Pilates, \textit{Your Health, A Corrective system of exercising that revolutionizes the entire field of physical education} (Incline Village, NV: Presentation Dynamics Inc., 1998), 2.  

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their highest efficiency.\textsuperscript{215} His statement of “more is not better” ignited a new way of practicing and monitoring exercises that addressed psychological or rather psychophysical or mind-body conditioning.

_Contrology_ was a fitness regimen that was based on several guiding principles that are still in practice today. These principles are derived from what Joseph Pilates interpreted as the governing “laws of nature”.\textsuperscript{216} Pilates’ six principles of concentration, centering, breathing, control, precision and flowing movement\textsuperscript{217} are integral in determining how well a Pilates exercise is executed. Two other principles were added later by modern Pilates instructors. The principles of isolation and routine were interpolated from Pilates’ writings in _Contrology_ and _Your Health_. The addition of these two last principles created a total of eight principles. All the principles are generally agreed upon by modern instructors, although the order of importance varies with how each style of Pilates is taught.

**Pilates’ Principles**

Joseph Pilates had listed his principles in a particular order of importance.

“Concentration” is first, and it is responsible for triggering the mind to activate before any physical action takes place; and is the preparation of both the conscious and subconscious mind.\textsuperscript{218} The second principle, “centering”, focuses on abdominal control versus abdominal strength. The “center” is the line across the hip bones.\textsuperscript{219} In Pilates, this area is also called “the core,” “the powerhouse” or the “pelvic floor”. The principle

\textsuperscript{215} Pilates and Miller, _Pilates Return to Life_, 7.
\textsuperscript{216} Ibid., 4.
\textsuperscript{217} Pilates, _Your Health_, 3.
\textsuperscript{218} Menezes, 21.
\textsuperscript{219} Ibid., 22.
of centering can also be described with respect to how the abdominal muscles and large back muscles help support us in our posture. The deep proprioceptive muscles involved in centering are the muscles that naturally give us our balance. Therefore, these muscles have also become the focus for training to improve posture.

"Breathing" is the third principle and is important since according to Joseph Pilates, breath energy is fundamental to any physical activity that aims to better develop length, strength and flexibility in muscles. Breathing promotes focus or concentration and centering, which inevitably becomes the foundation for the first two principles. In *Contrology* and various Pilates-based physical training methods, Joseph Pilates prescribes a specific breath pattern that specifies when and how to inhale and exhale for each exercise. The fourth principle, "control", is about being in charge of the movement rather than letting the body resort to its standard reflex actions. For example, in order to improve postural muscles, we do not want to resort to bad habits, but rather promote correct body symmetry and alignment of the spine. The fifth principle is "precision". It governs the accuracy of the motion and the placement of each movement in an exercise. This is determined by the biomechanics of the musculoskeletal system and controlled by the neuromuscular system.

The final principle listed by Joseph Pilates is "flowing movement". If flowing movements are used while exercising, then as he suggested, fluidity would result (including in every day movement) even when not exercising. Utilizing the principles

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220 Menezes, 24.
222 Menezes, 28.
223 Menezes, 29.
224 Ibid., 29–30.
of flowing movement with the other five principles, especially centering and breathing, results in motions that are not stiff or jerky. Suspension and fluidity in the joints and large muscle groups are developed when working from a well-conditioned core or powerhouse center.\(^{225}\)

Isolation is a newer principle in Pilates. It was always used by Joseph Pilates in his method but not listed specifically as a principle. The principle of isolation focuses on a specific muscle group for improving its function, strength or endurance.\(^{226}\) Today, isolation can be used for purposes ranging from recovery of injury to enhancement of performance by improving the efficiency of a targeted muscle group. Routine is the final and eighth principle. Repeating a series of exercises on a daily basis was encouraged in Pilates training. Joseph Pilates’ *Contrology* was developed as a way of life, so he expected Pilates to be integrated into daily routines. His repertoire of over five hundred exercises performable on a mat makes the technique very mobile and accessible. He also made exercises accessible as part of daily life by designing unique equipment that could be used at home as both a piece of furniture or gym equipment. His “Wanda chair” and “the Reformer” are in most Pilates studios today. *Contrology* was more than just a fitness regimen for people. Joseph Pilates suggested that his *Contrology* would help people live longer and reduce bad mental and physical health.\(^{227}\) It was a holistic approach to mind-body techniques with eight clearly stated governing principles.

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\(^{226}\) Menezes, 30.

In addition to his writings and video footage, Joseph Pilates trained several practitioners to be instructors of Pilates. Eve Gentry was one of the students that started teaching at his New York city studio in 1938. She was a dancer who chose to work also as an instructor at the Pilates studio until 1968. With her knowledge and experience of Pilates, she created a program called pre-Pilates. Pre-Pilates was taught as preliminary education to help practitioners and students understand the concepts behind Pilates-based exercises. Before her death at the age of eighty-four in 1994, she passed on this program to the next generation of teachers from her studios in Santa Fe and in San Francisco. Pre-Pilates became an integral part of the Pilates method at that time, and is still widely used today.

Concepts of Pre-Pilates

Eve Gentry was recognized as one of the most dedicated pupils of Joseph Pilates. A video or DVD of Eve Gentry’s pre-Pilates’ workshops is still used by instructors today to introduce the concepts of Pilates. Her pre-Pilates program of exercises describes the concepts of alignment, breathing, imprinting and joint release as it relates to the study and practice of Pilates-based exercises.

In her presentation, Gentry introduces “postural alignment” by describing the human anatomy as having five verticals and six horizontals. The five verticals are the spine, two arms, and two legs.228 The horizontals include the head, shoulder girdle,229 ribcage, hips

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228 Eve Gentry, Gentle Pre-Pilates Exercises to Assist in the Learning of the Pilates Method, VHS, Institute for Pilates Method, directed by the Institute for Pilates Method (Santa Fe, NM: Institute for Pilates Method, 1991).
knees and ankles. Gentry strictly reinforced that none of these horizontals are “placed,” locked or held in a particular position.\textsuperscript{230} The horizontals are suspended thus creating a fluid body from head to toe and through the extremities. For purposes of accessibility, Gentry also describes the target goals of correct posture when walking. She suggests that the sternum should stay in front of the belly and over the navel; the navel over the crotch (junction of the legs), and the crotch in front of the ankle bones.\textsuperscript{231} She uses walking as an important example, because it can be practiced as part of everyday life.

The second concept in pre-Pilates is “breathing”. Gentry describes how one must understand that the thoracic cage (i.e. ribcage, sternum and vertebrae) responds to respiration and that the goal is to increase mobility of this action with exercise.\textsuperscript{232} Mobility is directly proportional to the increase in range of motion\textsuperscript{233} (ROM) of the thoracic cage. ROM of the thoracic cage is determined by the extent to which it expands and contracts upon inspiration and expiration respectively. Breathing exercises are practiced in supine (on one’s back) position on the floor with knees up and parallel to each other with the feet on the ground. Gentry starts the breathing exercise with a nose breath upon inhalation but expiration through the mouth. She suggests that the torso is like a vessel, so that inhalation is like filling a pail with water, bottom to top.\textsuperscript{234} Upon the inspiration everything from the chest and the sides of the body should feel full and the expansion will also result in a lengthening of the spine.\textsuperscript{235} While still in supine position,

\begin{itemize}
\item \textsuperscript{230} Eve Gentry, \textit{Gentle Pre-Pilates Exercises to Assist in the Learning of the Pilates Method}, VHS, Institute for Pilates Method, directed by the Institute for Pilates Method (Santa Fe, NM: Institute for Pilates Method, 1991).
\item \textsuperscript{231} Ibid.
\item \textsuperscript{232} Ibid.
\item \textsuperscript{233} The term range of motion (ROM) generally refers to range of joint when bending (flexion) or extending (extension) it.
\item \textsuperscript{234} Gentry, \textit{Pre-Pilates}.
\item \textsuperscript{235} Ibid.
\end{itemize}
when the student exhales, they should feel the weight of the lengthened spine press into the floor. Gentry explores this spinal awareness, later in her discussion on the concept of “imprinting”.

Another part of preparing for efficient breathing is the “mouthwash” exercise. The action of the mouthwash exercise is to move air (versus mouthwash) throughout the mouth and the cheeks, pumping it up towards the eyes, and finally up through the temporomandibular (TM) joint. This exercise releases the TM joint and therefore allows the joint to relax during inhalation and exhalation. With reduced tension in the TM joint, it also frees up the throat, jaw, breastbone, shoulders, neck and spine; all areas which help facilitate good and efficient breathing. Following this initial preliminary exercise for breathing, Gentry discusses her exercise for breathing called “breastbone breathing”. In breastbone breathing, the sternum is raised with the widening of the thoracic cage as the scapulae or shoulder blades come down and parallel to each other for the entire breath cycle. Eventually the ribcage, which is attached to the sternum and sits under the scapulae, will become more flexible and mobile with routine conditioning. If there is a continued feeling of stiffness then Gentry suggests the “one lung breathing” exercise. The one lung breathing exercise is literally to focus on conceptually breathing into one side of the lungs at a time. Essentially the lung increases its capacity beyond normal daily respiration, creating forced inspiration and strengthening of the mind-body connection. The goal to improve the ROM of the thoracic cage is also achieved with the increased capacity of the lungs. Increase in the ROM of the thoracic cage can result in

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236 Department of Otolaryngology, “Temporomandibular joint,” University of Rochester Medical Center, http://www.stronghealth.com/services/surgical/ENT/tmj.cfm (accessed October 20, 2008). The term temporomandibular joint defined as “the joint where your lower jaw bone is connected to the temporal bone of your skull. It is covered with a thin layer of cartilage and separated by a small disk. This joint is almost constantly in use as you eat, speak and swallow.”
greater lengthening of the spine due to the vertebrae responding to the improved expansion of the ribs.

As introduced before, “imprinting” is the third major concept in pre-Pilates and is related to spinal awareness. This is an important but highly abstract concept. Imprinting is analogous to the action of “allowing gravity to release the weight of the spine downwards.” Imprinting in pre-Pilates is done in supine position on the floor with the knees up and parallel to each other and the feet on the ground. The student is asked to first inhale and then on the exhale, imagines the lumbar part of the spine dropping and imprinting into the floor. Imprinting helps further expand the spaces between the discs of the vertebral column. This includes the cervical vertebrae in the upper spine of the neck which also spread and lengthens when the thoracic cage expands upon inspiration and expiration.

In order to test the success of imprinting, Gentry uses the one leg slide test. Still in the supine position, after inhaling, if one leg can slide out during the exhale while keeping the imprinted spine to the floor, then the student is successful. Using an arm is an advanced test that can be done in supine position as one arm lifts vertically over the head without arching the spine (i.e. keeping the imprint). It is important to differentiate the concept of imprinting to being opposite of a pushing or pulling action. Successful results of imprinting are based on the necessity to release the tension in the both the general musculature around the spine including the muscles that support the individual

\footnote{Kelepecz, interview by author, November 20, 2008.}
Imprinting (or lengthening) helps create ROM and flexibility between the vertebrae in the curved areas of the spine, especially in the lumbar section of the spine. Once spinal awareness improves, it helps postural alignment in standing position, where a skilled mind-body connection can continue to work efficiently.\(^2\(^3\)9\)

The final concept in pre-Pilates is Gentry’s “joint release” exercise. Joint release addresses the concept of how to anchor or feel grounded in the body while standing; without locking (or stiffening) the abdominal muscles and hip joints. Gentry states that joints are fragile.\(^2\(^4\)0\) For example the hip joint is the ball and socket joint formed by the head of the femur (bone) and the cup-shaped cavity of the hip bone. In her knee stir exercise, again in supine position, the hip joint is released with the spine still imprinting while the knee is pulled up towards the chest. The student makes circular movements with the knee, releasing as much pressure as possible between the ball and socket joint of the hip.

In an effort to further educate students about the concept of joint release, Gentry introduces a prop called the foam roll.\(^2\(^4\)1\) In the “foam squeeze” exercise, while the foam roll or yoga ball is squeezed between the knees so that the hip joints and the sacroiliac (SI) joints release and open up. The SI joint is between the sacrum and the ilium and associated ligaments.\(^2\(^4\)2\) A widening of the lower back is felt when the SI joint opens, demanding greater support from the abdominal muscles, the quadratus lumborum and the

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\(^{238}\) Kelepecz, interview by author, November 20, 2008.
\(^{239}\) Gentry, Pre-Pilates.
\(^{240}\) Ibid.
\(^{241}\) One could also use a small ball or yoga ball.
\(^{242}\) “Sacrum,” Biology-Online, http://www.biology-online.org/dictionary/Sacrum (accessed November 18, 2007). The term sacrum defined as “the triangular shaped bone lying between the fifth lumbar vertebrae and the coccyx (tailbone). It consists of five vertebrae fused together and it articulates on each side with the bones of the pelvis (Ilium) forming the SI joints.”
muscles of the center or core. This support helps relieve tension as far up as the head and
neck.

Gentry insists that less tension in the head and neck area allow for better spine
articulation.\textsuperscript{243} She adds exercises to help promote an articulate spine from head to
tailbone. The cervical vertebrae or upper part of the spine is articulated when the head
and neck are lifted off the floor in a “head roll up”. This can be done in neutral spine
where the natural curve of the lumbar spine is maintained. The coccyx curl exercises
which create c-curve of the spine, focus on imprinting the base of the spine. The curling
up action or lengthening of the tailbone or coccyx is initiated when the deep abdominal
muscles and pelvic floor muscles are engaged. The c-curve exercises enhance the ROM
and flexibility of the lower spine.

The purpose of pre-Pilates is to understand the concepts behind Pilates-based exercises.
Alignment, breathing, imprinting and joint release are necessary when performing Pilates
exercises. Although there are several methods of Pilates exercises that have developed
and evolved over the decades since the 1930s, pre-Pilates has remained consistent as the
underlying program to help preliminary education of the concepts in Pilates-based
physical training methods.

\textbf{Modern Pilates}

Modern Pilates was catapulted into the mainstream fitness world in the late 1980s and
early 1990s, and continues today.\textsuperscript{244} As a result of its popularity, first generation teachers

\textsuperscript{244} Leslee Bender, “Practical Pilates Training with a Small Stability Ball,” \textit{findarticles.com, American
of Pilates methods branched out across North America and England. They represented various styles and schools of traditional Pilates. A second generation of teachers emerged from this movement.

Elizabeth Larkam was a protégé of Eve Gentry and other pupils of Joseph Pilates. It was fitting that she was based out of the San Francisco Memorial Hospital since her specialty was as a dance medicine Pilates specialist. She was also recognized for being a pioneer of innovative mind-body movement techniques for the arts and academic settings. Dolly Kelepecz was a pupil of both Eve Gentry and Elizabeth Larkam in San Francisco. She was certified in 1987 by Elizabeth Larkam. Ten years later Kelepecz trademarked her own Pilates-based physical training method called the DK Body Balancing Method (DKBBM).

In DKBBM, instructor Kelepecz trains with Pilates-based exercises that are supported by the concepts of pre-Pilates and the governing principles of traditional Pilates. She was able to apply this method to her own training as a professional dancer that spanned over thirty years, during which she also sang professionally. Her interest in rehabilitative exercise stems from her experience in physical therapy and massage therapy. Kelepecz is also trained in other mind-body techniques including the Alexander Technique, the Artforms system, Feldenkrais and Gyrotonics.

Since Pilates is a mind-body technique, the students who can benefit from this technique vary from regular fitness clients to physical therapists, athletes and performing artists. Kelepecz also uses DKBBM to help care for patients with medical conditions such as brain cancer, multiple sclerosis (MS) and other neurological and physiological dysfunctions. She has built a Pilates-based exercise studio in the dance department at the
University of Nevada, Las Vegas, where she also certifies new teachers in her method. She has studios in the greater Las Vegas area as well as Mexico, Japan, and Korea.

Areas of Focus in DK Body Balancing

Method of Pilates

Kelepecz’s method is unique in the plethora of Pilates styles today since she has mandated, like the original Pilates technique, that a complete and maximum breath cycle must be part of each exercise. This particular procedure is especially beneficial to disciplines or techniques teaching controlled breathing as part of their process. Singing is one such technique.

DKBBM is described by Kelepecz as an internal workout with specific breathing patterns that center on the spine and joint stabilizers. Her technique “strengthens the pelvic floor and the transversus abdominis (TrA) for improved spine stability.” The pelvic floor muscles (PF) connect to the very base of the spine, the coccyx or the tailbone, the ischium or the sitting bones, and the pubis. The PF muscles as listed by the DKBBM consist of the levator ani (pubococcygeus, iliococcygeus), coccygeus and aburator internus. The deep proprioceptive TrA line the pelvic wall and travel up to the mid-thoracic region. According to a growing body of research, if these muscles are not stabilized with the other major muscle groups when performing a Pilates-based exercise (or physical exercise) then the spine cannot be in its optimal alignment.

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246 Ibid.
248 Ibid.
249 Ibid.
focus of all Pilates methods, as with the DKBBM, is a focus on the center, core or powerhouse (Figure 3).

Figure 3. Components of the Powerhouse: (a) The powerhouse contains the pelvis and the abdomen. (b) The joints within the abdomen are the lumbar spinal joints. The pelvis is a body part that is bounded by the lumbosacral joint superiorly and the hip joints inferiorly.

Anatomically, the components of the "powerhouse" are important areas including bone structures of the body that define the framework of the core. The abdomen and pelvis are especially important. The bones in the torso area concentrate on the lumbar part of the spine and the associated sacral and hip joints. The components of the powerhouse also include specific muscle groups associated with it.

There are five major muscle groups that dominate the powerhouse or core (Figure 4). These groups of muscles extend from the upper thoracic area of the body down through the legs, including the lowest PF muscles of the pelvis (Figure 4 d).
Figure 4. The major muscle groups of the powerhouse:

The five major muscle groups of the powerhouse are the anterior abdominals (a), posterior abdominals, i.e., low back muscles (see b), hip flexors (c), hip extensors (d), and the pelvic floor muscles (e).

The front and lower back surface abdominal muscles of the trunk include the rectus abdominis, the internal and external obliques, the quadratus lumborum and the
sacrospinalis (erector spinae). The front and lower back deep abdominal muscles include the TrA and lumbar multifidus. The hip extensor muscles work in tandem with the large surface abdominal muscles along with the hip flexors to help stabilize upright posture.

The deepest muscles of the powerhouse or core are the PF muscles. They work with the TrA, diaphragm and lumbar mutifidus for primary stabilization of the pelvis and spine.

The deep muscles for primary stabilization help create correct posture and balance as the foundation for efficient biomechanical functions. According to a study that integrated Pilates-based core strengthening in another fitness program,

> The TrA has revealed itself as one of the more important muscles in torso stability. TrA activation is independent and continuous during trunk movement, is controlled independently of other trunk muscles, and is recruited prior to limb movement.

Due to the continuous activation of the deeper muscles for stabilization, it is necessary to always consider the powerhouse or core while performing strengthening Pilates-based exercises. The benefits of working with Pilates-based exercises are based on principles in kinesiology and neurophysiology. The benefits of practicing Pilates-based exercises include improvement of posture by lengthening and aligning the spine; breath management; joint flexibility (i.e. ROM); muscle flexibility, strength and endurance; and skilled mind-body conditioning with coordinated sequencing.

DKBBM introduces other important concepts or goals for more benefits when practicing a Pilates-based physical training method. DKBBM mandates that proper breathing with a deep or forced inspiratory breath precedes any eccentric (lengthening)

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252 Ibid.
contractions of the target muscle groups in an exercise while all the time engaging the abdominals of the powerhouse.\textsuperscript{254} This approach to physical training results in body symmetry as well increased range of motion (ROM) of joints stabilizers and increased strength and stamina in muscles of the core. Another goal fundamental to DKBBM is to ensure that the students know the exact sequence of events between mind and body needed to achieve accurate anatomical placement in an exercise.\textsuperscript{255} The sequence includes all events in the body, regardless if the actions are voluntary or involuntary, conscious or subconscious.

Breath management is a primary concept in DKBBM. The breath cycle is initiated by a deep diaphragmatic breath. Once the deep diaphragmatic breath is established then percussive breathing can also become part of the practice. Each Pilates-based exercise has a dictated sequential protocol based on the breath cycle. This approach helps to create better body symmetry and awareness due to “stimulation of proper neurological innervations.”\textsuperscript{256} This is also why Pilates-based physical training is categorized as a mind-body or psychophysical technique.

Maintaining body symmetry eventually becomes a subconscious effort and part of the autonomic nervous system after repeated practice. Since Pilates-based exercises are an ideal joint stabilizer, it creates more fluidity in biomechanical functions of the body. Involving the entire body with mind-body coordinations help students become aware of not only the biomechanical relationship of the head, shoulders, ribcage, hips, knees, and ankles, but also the relevance of involving the neuromuscular system. For example, in a Pilates exercise, the deep and small muscles of the ankle, if misaligned or weak, can

\textsuperscript{255} Kelepecz, interview by author, November 9, 2007.
\textsuperscript{256} Kelepecz, \textit{DK Body Balancing Method}, 2007, introduction.
create asymmetry and instability throughout the important postural structures of the body, including the spine. Conscious training through sequencing coordinations, both mentally and physically within the entire body, further strengthens the mind-body relationship of the deep proprioceptive muscles of the core or powerhouse. With the unification of a specific breathing pattern, spine stability, joint stabilization and training by understanding the sequence of events in an exercise, DKBBM becomes an ideal Pilates-based exercise regimen that has potential synergies to help improve training for other mind-body techniques.

Pilates Summary

In the early 20th century Joseph Pilates introduced the world to Contrology, a new revolutionary fitness program with its focus on the principles of concentration, centering, breathing, control, precision, flowing movement, isolation and routine. Eve Gentry, a first generation teacher of Joseph Pilates in the mid to late 20th century, introduced the concepts of the Pilates method by establishing a program called pre-Pilates. Dolly Kelepecz, the creator of the DK Body Balancing Method of Pilates-based exercises, integrates the principles of Joseph Pilates, the concepts of Eve Gentry and her own practices in a modern day approach to a Pilates-based physical training regimen. Her method can also be described as a psychophysical program. It advocates skilled mind-body conditioning including proprioception and mental training through sequential understanding of the body's coordinations in order to create a well-balance mind-body physical training regimen. Certain target goals for DKBBM Pilates are the same as those for nonphonatory training for volition and respiration in the vocal process.

The Role of Proprioceptive Neuromuscular Facilitation (PNF) in Mind-body Techniques

It is important to acquire accurate and sufficient information about mind-body techniques, when developing an integrated method for voice performance training. The anatomy and physiology of mind-body techniques goes beyond biomechanics and kinesiology alone. The CNS has been described as an important part of breath support in singing. Therefore, the science of neurophysiology must also be explored in order to understand how we can discover ways to further improve neuromuscular activity in singing. This knowledge is advantageous to have when considering how to create an integrated method between the two mind-body techniques of singing and Pilates-based physical training.

PNF addresses the underlying mind-body benefits of singing and Pilates-based exercises. James Stark, author of Bel Canto: A History of Vocal Pedagogy, reports that proprioception and proprioceptive control are at the center of the autonomic mechanisms involved in posture and breathing in singing. Pilates-based exercises are developed from knowledge about neuromuscular and biomechanical processes that help correct and improve posture and breath management. The technique of PNF is used in training in order to increase proprioceptive control. This technique can help illustrate certain aspects of mind-body training as it relates to the complete neuromusculoskeletal system.

PNF is an intricate system that relies on the laws of psychophysics. Its techniques are based on "theoretical models [that] can summarize observed relations between stimuli

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and responses." As its name implies, proprioception is a significant component in PNF training. PNF using proprioception is "a method of promoting a response of neuromuscular mechanisms through the stimulation of proprioceptors in an attempt to facilitate increased range of motion (ROM), increased strength, and movement pattern control." Due to a growing amount of clinical evidence, PNF has become fundamental to helping to correct posture while also improving breath management. PNF can therefore be investigated as to how it may address the neurophysiological and biomechanical aspects of both singing and Pilates-based exercises.

PNF is a technique that was developed in the 1940s and early 1950s by Maggie Knott, Dorothy Voss and Herman Kabat. The philosophy of PNF is that "all humans have untapped existing potential." Initially, patients with neurological dysfunctions were treated with this technique. The purpose of clinical applications was to address ROM with the use of increased resistance training. It also introduced various combinations of "primitive movement patterns" to help correct posture and reeducate reflexes. These

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movements have now been standardized as basic types of stretching techniques within PNF.\textsuperscript{267}

Clinical research has shown that PNF techniques used as a diagnostic tool and a training tool can help improve postural orientation, functional movements, flexibility, muscle strength and stamina.\textsuperscript{268} The technique is based on various exercises that make use of neural mechanisms with proprioceptive characteristics that help to improve and solidify how a mind-body skill is learned.\textsuperscript{269} For example, one goal in a PNF exercise is to help the body “move in functional patterns” by using mechanisms related to neuromuscular-feedback.\textsuperscript{270} Another goal is to reeducate isolated muscles for specific functional movements by continually developing control of the thoracic muscles, the PF muscles including the deep TrA, and the ability to perform fluid coordinating movements.\textsuperscript{271}

Support for PNF is most prevalent in its clinical applications with athletic training and with physical therapists who help to alleviate problems related to ROM, muscle strength, endurance, and proprioception.\textsuperscript{272} The advantage of this technique in its clinical application is that it can be performed individually by the student or with manual assistance by a trainer or instructor ensuring a more accurate practice of the exercise.\textsuperscript{273} Although there is still a need for more studies and research in this area, clinical results

\textsuperscript{267} Stone, “PNF,” 38–39.
\textsuperscript{268} Johnson and Johnson, “Principles and Procedures of PNF,” 83–84.
\textsuperscript{269} Ibid.
\textsuperscript{270} Stone, “PNF,” 38–39.
\textsuperscript{271} Johnson and Johnson, “Principles and Procedures of PNF,” 83–84.
\textsuperscript{272} Stone, “PNF,” 38–39.
\textsuperscript{273} Alter, \textit{Science of Flexibility}, 165.
support the theoretical models that demonstrate the neurophysiological aspects based in PNF techniques.  

There are two systems at work in PNF. They are categorized into five parts that work together as one mind-body technique. The two systems are divided into the neuromuscular or proprioceptive system and the musculoskeletal or biomechanical system. The proprioceptive system consists of the first two parts: neurophysiology of proprioception, and the central nervous system proprioceptor sites. The second biomechanical system consists of the other three parts: balance, coordination and agility (Figure 5).

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Neurophysiology of proprioception includes all the various categories of receptors in the skin, muscles, tendons and joints. These receptors influence proprioception directly affecting posture, movement, balance and location of the body. The CNS proprioceptor sites are separated in three sections according to their location in the body. The first section is the spinal cord. It is responsible for the instant response system in the body. The second part is the brain stem which regulates the body’s posture and its balance as it responds to stimuli (or proprioceptor sites) in the deep abdominal muscles. The final and third section is the cerebral cortex. The cerebral cortex regulates feedback, performance adjustment, and volition of a particular exercise. The biomechanical or musculoskeletal system engages only after the neuromuscular system has been initiated.
The third part of PNF is balance as it relates to the entire body. Balance utilizes proprioception and an element related to fluid in the ear. The proprioceptive component is where the deep abdominal muscles give feedback regarding body equilibrium based on its center of gravity. Once this is achieved then coordination is introduced as the fourth part of PNF. Coordination deals with the perception of a movement pattern. Coordination is also a part of training where accurate exercising results in precise and efficient innervations between body and mind.\footnote{Hougum, \textit{Therapeutic Exercise for Musculoskeletal Injuries}.} Again, this is where manual assistance during an exercise for improved performance can be beneficial to the student. The components of coordination are biomechanical in action, while they relate to the cerebral cortex in the neuromuscular system.

Agility is the final part of the biomechanical system in PNF. Agility is dependent on the preexisting conditions of balance and coordination. It is an advanced skill built on both flexibility and strength. Agility is the part of PNF that is responsible for learning a complex action slowly first and then progressively making it faster so that finally it can become an automatic response. According to \textit{Athletic Therapy Today}, this process can be facilitated by an instructor using hands-on training, or visual or verbal cues.\footnote{Stone, \textit{“PNF,”} 38–39.} This article describes how the development of muscular strength can be measured by speed in a specific exercise, and therefore indicates better mind-body conditioning.\footnote{Ibid.} According to the authors of “The Application of the Principles and Procedures of PNF for the Care of Lumbar Instabilities,” each movement learned by the student is reinforced through

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\begin{itemize}
  \item \footnote{Hougum, \textit{Therapeutic Exercise for Musculoskeletal Injuries}.}
  \item \footnote{Stone, \textit{“PNF,”} 38–39.}
  \item \footnote{Ibid.}
\end{itemize}
repetition in an appropriately demanding training program, developing a base line level of muscular strength and endurance.  

Evidence to Support the Benefits of PNF-based Techniques

PNF stretching has a complete neuromusculoskeletal process that addresses the systems involved in teaching psychophysical or mind-body techniques. As reported in evidence-based medicine, the benefits of PNF techniques are increased ROM, less tension in the muscles, improved mind-body conditioning with skilled sequencing of movement, and more efficient performance in training.  

Sharman, Cresswell and Rick note that the benefits of a program of PNF techniques that focuses on eccentric muscular contractions, delivers the most effective results for ROM in a short term training period. Another advantage regarding this type of training is reported in “The Science of Flexibility.” It notes evidence that when a method of training integrates improvement of both flexibility and strength, it may also help in preventing overuse injury.281

Although PNF has shown by clinical study to have several benefits, there can be two areas of concern with the application of this type of technique. The first concern is that the technique is dependent on initial supervision and instruction. This requires the student to be self-motivated and self-disciplined in his or her practice and maintenance of

281 Alter, Science of Flexibility, 177.
the technique.\footnote{Alter, \textit{Science of Flexibility}, 177.} PNF-based techniques must be practiced with accuracy or it may cause injury.\footnote{Ibid.}

The second concern with PNF-based techniques is that there is a risk of creating the Valsalva phenomenon.\footnote{Ibid., 167.} The Valsalva phenomenon can only occur if there is closure of the glottis (restricting airflow) upon a forced expiratory effort.\footnote{Ibid.} This is a negligible concern when discussing PNF techniques in the context of singing and Pilates-based exercises, because both singing and Pilates-based exercises make it necessary to implement a complete and continuous breath cycle for each exercise. Although most studies show clinical support for benefits in the application of PNF techniques, there are still recommendations for a need for more research with well-designed studies and sound methodology.

\textbf{PNF and Pilates Shared Principles}

Many principles of training are shared by Pilates-based exercises and PNF techniques. They are similar in how the exercises are practiced and measured for success. Both PNF and Pilates target goals for training include increased ROM, release of muscle tensions, and mind-body conditioning with skilled sequencing of movements.
With regards to the biomechanical system in both techniques, agility is not achieved until balance and coordination are mastered first. The ideal progress of an exercise ranges from simple to complex. The exercise needs to be performed slowly, accurately and in a controlled situation. These goals need to be met and mastered in simple exercises before advancement is made to a more complex activity.

When more complex exercises are being performed, they demand a more powerful output (i.e. strength and stamina), and the goal is to not only perform them accurately and repeatedly, but to do so without showing signs of fatigue. The addition of arm or leg movement in respiration is considered to be a complex action. Trunk and postural muscles should be developed for controlled breathing before attempting more advanced exercises with extremities. Smith and Smith present evidence that supports how PNF, like Pilates-based exercises, uses volitional training to improve strength and endurance of the TrA, the lumbar multifidus, PF muscles and the muscles of breathing.\footnote{Smith and Smith, “Integrating Pilates-based Core Strengthening,” 66.} As reported by physiotherapists Lee and Associates, the multifidus needs to be developed for stabilization in controlled breathing before attempting more advanced exercises involving the arms and the legs. This is due to its parallel muscle functions with the TrA and PF muscles related to the trunk of the body.\footnote{Diane L. and Associates, consultants in physiotherapy, “Multifidus, Empower through Knowledge, Movement & Awareness Location, Function & Dysfunction (White Rock, BC: Diane Lee and Associates, 2007), http://dianeele.ca/services/MULTIFIDUS.pdf (accessed November 30, 2007).} Therefore, since core and powerhouse muscles are fundamental to postural and breath management training in both Pilates-based exercises and PNF, we can ascertain that PNF-based models are an integral part of Pilates-based physical training as well.
Why We Can Apply Pilates-based Exercises to the
Study and Practice of Singing

PNF can act as a bridge in explaining the physiological, mind-body benefits of the techniques of singing and Pilates-based physical training. It helps establish the common language needed to describe the complex sensations related to posture and breath management in the study and practice of singing as well as Pilates-based exercises. Therefore, singing students should consider the use of PNF-based exercises in a Pilates-based physical training method for improved voice performance training.

With detailed knowledge of both the proprioceptive and biomechanical systems involved in singing or Pilates-based exercises, we are able to observe the parallels of the two techniques. These synergies are strongly connected by the objectives and the governing principles already established in each individual technique, in their study and practice for optimal performance.

Pilates-based exercises and singing exercises share the benefit that, with disciplined practice and repetition, the target goals of certain exercises can eventually become part of the subconscious mind and autonomic nervous system. Pilates-based exercises can both measure and monitor success of an exercise. It would be beneficial to use this measurement scale to determine the level of a student within a certain mind-body physical training program for improving voice performance.

Body mechanics, posture and correct breathing, acting with a skilled mind-body connection, all play a role in learning correct breath management and posture for singing as much as for Pilates-based physical training. In both Pilates-based exercises and singing, correct breathing is central to many of the biomechanical and postural elements.
As Miller suggests, “[p]rephonatory exactitude...may be acquired through the systematic drill of breath management-breath pacing-exercises.”\textsuperscript{288} Nonphonatory training in singing shares similar target goals, with certain Pilates-based exercises in its focus on posture and breath management with a skilled mind-body connection. In addition, breath management in both Pilates-based exercises and in singing is approached differently from everyday respiration. With the appoggio method in singing as well as nonphonatory training, the position of the sternum is high and thrust forward. Pre-Pilates suggests that the sternum sits out above the navel in standing position or when doing the breastbone breathing technique. The position of the sternum is high on the inspiratory breath (natural or forced), and is maintained in singing or the expiratory breath without phonation. This coordination is also possible in Pilates-based exercises during controlled forced expiration and renewal of breath. Increased ROM of the thoracic cage as a result of specific Pilates-based exercises are beneficial for enhanced vital lung capacity and complemental breath\textsuperscript{289} in singing. Flexibility and strength of the ribcage’s intercostals are also fundamental in improved breath management in Pilates-based exercises as well as breath control in singing.

In correct breathing, because of the expansion of the ribcage, there is a lengthening of the spinal vertebrae. Like in Pilates-based physical training, posture in singing, focuses on a lengthened and aligned spine. For both techniques, this expansion runs from the clavicles in the upper spine in the neck area down to the tailbone or coccyx in the pelvic area.

\textsuperscript{288} Miller, The Structure of Singing, 38.
\textsuperscript{289} Vennard, 244. The term complemental breath defined as “air which may be inhaled in addition to tidal breath, by effort.”
Pre-Pilates uses a technique called imprinting that can help a singer understand alignment and imprinting of the spine by engaging and releasing the muscles around the vertebral column. Pilates dictates that if there is tension in the neck and head, then the spine is not free to articulate. This is also true in singing. Both Pilates and singing therefore, identify the SCM and scalenus neck muscles as important for posture and fluidity in the body for more efficient biomechanical functions. The SCM are the support muscles from the torso to the neck. The mouthwash technique in Pilates releases the temporomandibular joint, releasing the muscles in the neck. These neck muscles work in favor of efficient breathing in Pilates-based exercises. They protect the laryngeal area and all its muscles.

Another parallel between singing and Pilates-based exercises is that the abdominal muscles can be activated by the respiratory organs during the ideal breath cycle of a deep or forced inspiratory breath and controlled forced expiratory breath. In singing, the external obliques are contracted just before controlled forced expiration. In DKBBM the breath always precedes the action when practicing an exercise. The TrA are engaged at all times in correct breath management in both singing and Pilates-based exercises. As Jarmey describes in *The Concise Book of Muscles,* the TrA are one of the most important muscle groups fundamental to good posture and controlled forced expiration. The TrA refine coordination and precision of breath support and breath control in singing. Their strength and stamina enhance the intensity of breath energy in singing. These muscles are part of the powerhouse or core as described in Pilates-based exercises.

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290 Sataloff, *Voice Science,* 65. The term temporomandibular joint defined as “The jaw joint; a synovial joint between the mandibular condyle and skull anterior to the ear canal.”

291 Jarmey, 57.
The diaphragm is the primary muscle involved in respiration. Training with the powerhouse muscles can directly affect the diaphragm. The diaphragm’s origin includes an attachment to the L1 to L3 vertebrae. There is an increase in ROM of those vertebrae and flexibility of the lower spine when the powerhouse is engaged in the Pilates maneuver called the coccyx-curl which creates a c-curve in the lower spine. Since the ROM increases in the L1 to L3 vertebrae, then the diaphragm can improve in its contraction upon inspiration and allow for more room for the lungs to expand in the thoracic cage. Also, the deeper proprioceptive muscles involved in controlling the movement of the diaphragm become stimulated with the correct neurological innervations to help with controlled expiration necessary for singing.

Since the transversus abdominis is the primary deep proprioceptive abdominal muscle group active in controlled forced expiration in singing, then there is a direct correlation that Pilates-based exercises can help singing training. A kinesiology study by Carolyn Watson examined the effects of Pilates training on the transversus abdominis. It concluded that ten weeks of Pilates training with skilled mind-body conditioning significantly improved the function of the transversus abdominis. One can conclude that not only the function of the transversus abdominis improved, but, because of the necessity for a skilled mind-body connection, volitional training improved as well. This is advantageous to a singer since the abstract idea of breath support can be realized by training tangible muscle groups in the powerhouse through improved volitional training.

One distinct parallel in functional anatomy between singing and Pilates-based exercises is the description of a sphincter-like action in the lower back and abdominal area. As described in voice pedagogy, the abdominal muscles act with the latissimus dorsi to create a circle of support in the lower back and abdominal area in controlled forced expiration. This abdominal area or powerhouse is always engaged in Pilates-based exercises when muscles are being eccentrically or concentrically contracted, stretched or flexed. Therefore, once again, Pilates-based exercises could help facilitate further training for this type of function in singing.

Joint release and joint stability in pre-Pilates and Pilates-based exercises supports a suspension in the body that relieves pressure on the joints. This suspension is also necessary in singing. The foam squeeze exercise (or small ball) in pre-Pilates releases the SI joint (sacroiliac) in order for the quadratus lumborum to free up its constant activation for stabilization of the pelvis. The quadratus lumborum is a target muscle group involved in respiration and in postural alignment. It is beneficial to stretch the quadratus lumborum for improved flexibility, strength and stamina in both Pilates-based exercises and for singing.

Ultimately, breath management and posture are the central idea that connects singing and Pilates-based exercises through specific biomechanical and neurophysiological aspects. Although PNF is a fundamental part of an integrated method between singing and Pilates-based physical exercises, it does have limitations. PNF can help monitor breath management, but it does not address the importance of respiration or incorporate breath regimens as a part of its practice. Therefore PNF cannot be considered an independent technique within the development of an integrated method for voice
performance training. Exclusive of PNF, the related topics of breath management and posture further solidify the strong connection between the techniques of singing and Pilates-based exercises.

In conclusion, there are three main areas that summarize why we can apply Pilates-based exercises to the study and practice of singing. First, there is a defined process of controlled breath management, coordination and posture in Pilates-based physical training. Singing shares similar proprioceptive and biomechanical functions. Second, the principles, concepts and target goals in Pilates-based exercises define and clarify vague singing terms like “good posture, abdominal tuck, inspiration (in, down, out); suspension; expiration (in, up, out) and singing on the breath.”293 Finally, agility is discussed in Pilates and PNF as the complex and more advanced activity that can only be mastered after feedback messages for balance and coordination are achieved. Singing shares the advanced skill of agility as an indication of expert training.

In drawing parallels between singing and Pilates-based physical training, the conclusion can be drawn that the techniques of PNF-based models are seen as a bridge to help establish the common language for an integrated method between the two mind-body techniques. The integrated method of Pilates-based exercises will address nonphonatory training of volition and respiration in training for voice performance.

293 Miller, “The Singing Teacher in the Age of Voice Science,” 201.
Avoiding Overuse Vocal Injury - Evidence to Support Overuse Injury

The main responsibility of a singing teacher, according to Miller, is to “(a) analyze vocal problems and (b) design proper solutions for them.”294 With new information from voice science, teachers of singing are given the opportunity to integrate new terminology into their studios that may help students who have not responded well to the more traditional approaches to voice pedagogy.295

Integrating mind-body techniques by recognizing relevant synergies related to anatomical, biomechanical and physiological aspects, is advantageous for improved results in training and in avoiding overuse injury. PNF underlies the mind-body benefits in both the techniques of singing and Pilates-based exercises. All aspects of PNF can be described in both singing and Pilates while simultaneously considering the process of proprioception. All three mind-body techniques reference posture as a basis for certain target goals for both the mind and body aspects of training. Pilates-based exercises are shown to help improve postural alignment.296 Pilates-based exercises can help improve posture for singing as it relates to its role in nonphonatory training of volition and respiration. This is substantiated in a report from The Journal of Voice that supports with evidence-based medicine, the importance of posture reeducation for rehabilitation or prevention of voice disorders in voice pedagogy and voice science.297

294 Ibid., 200.
The function of controlled breathing for breath management is also shown to be fundamental to optimal performance in singing technique and Pilates-based physical training. With this information, an integrated method for training singers with Pilates-based exercises for posture and breath management cannot only help improve training for voice performance, but it can also help develop a physiology that avoids overuse vocal injury.

One risk of injury with this integrated training method, as mentioned in PNF, is the Valsalva phenomenon. During forced expiration, students practicing Pilates-based exercises have to keep the spine aligned and lengthened while engaging abdominal support and keeping an expanded thoracic cage. This synergistic approach to training supports Miller’s advice regarding the importance of reducing and ultimately eliminating laryngeal tension as part of better voice production in the study of singing. These two considerations when integrated into a program for voice training can dramatically reduce the presence of any physical pressure on the vocal cords as well as tensions in the neck area that may occur due to advanced levels of muscular contractions in the body. It thereby reduces the risk of developing the Valsalva phenomenon and other possible vocal injury during practice of PNF-based exercises in a Pilates-based physical training method for singers.

A benefit of an integrated method of Pilates-based exercises that focus on nonphonatory training for singers, is that it can become a tool for rehabilitation after vocal trauma or injury. The integrated method could also help identify the weaker muscles or mind-body coordinations in exercises that target the muscles for volition or respiration of the vocal process. Once problems are identified, a program of Pilates-

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based exercises could be created to help the student reeducate or rehabilitate these areas. The program would therefore prevent further injury until a healthy and accurate practicing method for improvement is established.

Conclusion to Anatomy and Physiology of Posture and Breath Management

Evidence-based literature from biomechanics, kinesiology and neurophysiology indicates that Pilates-based physical exercises are relevant to the study and practice of singing. Joseph Pilates devoted many years to the study of science and art and created a definition for the general principles that underlie the balance of body and mind:

[N]either the mind nor the body is supreme – that one cannot be subordinated to the other. Both must be coordinated, in order to...accomplish the maximum results with the minimum expenditure of mental and physical energy.\textsuperscript{299}

This definition could also be applied to singing. Miller explains that “high tessitura singing cannot be at a fixed energy level: at such moments one needs imagination, an increased flow of adrenaline, the body is keyed up, and the full athleticism of the singer is brought into play.”\textsuperscript{300} He also suggests that “a fine teacher combines mechanistic information with the psychological and the aesthetic.”\textsuperscript{301} By integrating principles and concepts from Joseph Pilates’ Contrology and Eve Gentry’s pre-Pilates with DKBBM Pilates-based physical training, a new type of mind-body technique is offered that can be translated and applied to nonphonatory training of volition and respiration in voice performance training.

\textsuperscript{299} Pilates and Miller, Pilates Return to Life, 27.
\textsuperscript{300} Richard Miller, The Structure of Singing, 41.
\textsuperscript{301} Miller, “The Singing Teacher in the Age of Voice Science,” 200.
Posture and breath management with skilled mind-body connections are synergistic between singing and Pilates-based physical training, and are exclusive of PNF. There is literature in evidence-based medicine that supports the importance of improving posture when training to improve performance of the vocal process and Pilates-based exercises. Both techniques use a complete breath cycle with the delayed rate of expiration (controlled forced expiration) for optimal results in training. Therefore, in consideration of posture and breath management in volition and respiration, an integrated method of Pilates-based exercises can be created to improve voice performance training.

There continues to be a growing interest in mind-body techniques and specifically how Pilates-based physical training can benefit training for posture and breathing for singers. In December 2007 when I began my research for this document, there was scattered information in commercial books, magazines or on Pilates studio websites that generally referenced the benefits of Pilates for singers. In February 2009 extensive Internet research had shown an increase in the number of postings in online music forums with questions asking about Pilates and its postural and respiratory benefits for singers. With the exception of myself, there is also an international listing of a voice studio

(4) Melissa Perry, voice teacher, http://www.vocalist.org/iregional/newjerse.html (accessed February 1, 2009). Note by M. Perry: “I teach voice lessons to all levels of students (beginners to advanced and all ages) in classical, pop, and musical theater styles. I use a method that I learned in Italy coupled with principles from Pilates. This vocal training focuses largely on understanding and improving breath support and increases resonance to enhance the tone and create a sound that truly projects with minimal effort.”
teacher who is also a certified Pilates instructor. Currently, there has been increased awareness regarding the relationship between singing and Pilates-based physical training. Scholarly research and publication of articles in peer-reviewed voice journals can only benefit further resolution in how we can apply Pilates-based physical training to improve posture and breath management as it relates to volition and respiration in the study of voice performance.

CHAPTER 4

METHODOLOGY – SEQUENTIAL PROTOCOL TO DERIVING AN INTEGRATED METHOD

In a beginner level program, the integrated method will not involve phonation or vocalizing as part of the exercises. As a voice teacher and Pilates instructor, the emphasis on correct posture and breathing for singers with a skilled mind-body connection must be mastered at the beginner level before phonation can become part of their training. In a mechanistic pedagogical approach to teaching singers, the integrated method of Pilates-based exercises derived for voice performance training can further support how singers already train for nonphonatory training in the vocal process.

A Pilates teacher does not teach the technique of singing. However, the teacher of an integrated method of Pilates-based exercises for singers will need to take into consideration any variations or modifications that may exist between the two techniques. The integrated method will therefore make allowances for these modifications within the standard practices of both singing and Pilates-based exercises. These variations or modifications will be discussed as part of the integrated method.
Methodology

Previous knowledge necessary before addressing the methodology:

Step 1. A review the muscles that take part in volition and respiration for singers as defined by expert vocal pedagogues in nonphonatory training.

Step 2. A review the muscles of the body that support by their points of origin, insertion, action and basic function, posture, controlled breathing and mind-body conditioning as defined by Pilates-based physical training.

The Sequential Protocol to Deriving and Integrated Method

Step 1. List the specific primary and secondary muscles that support improving posture and breath control and breath management, that can be shared by both the techniques of singing and Pilates-based exercises.

Step 2. Review a method of Pilates-based physical training, and use the exercises relevant to the primary and secondary muscles listed in step 1.

Step 3. List any variations or modifications to the Pilates-based physical training exercises that are necessary for a student training for voice performance.

   a. Include notes on determining the level of a student practicing the integrated method.

Step 4. CHART SUMMARY Arrange the exercises in a chart summary to represent the integrated method of Pilates-based exercises for singing. Arrange the chart in a form appropriate for teaching a student new to a method in Pilates-based physical training.

Step 5. REPETITIONS (REPS): Add a column in the chart summary that describes the number of repetitions of each exercise

Step 6. BENEFITS FOR SINGERS: Create another column that describes the benefits for singers based on target goals shared by both mind-body techniques of singing and Pilates-based physical training

Step 7. RECOMMENDED SCHEDULE: Recommend how often the integrated voice performance training method of Pilates-based exercises should be performed on a daily or weekly schedule for new students.
CHAPTER 5

RESULTS OF METHODOLOGY - PART I

Methodology Step 1 – List of Important Muscles

Fundamental to Both Singing and Pilates

Table 1. List of Important Muscles Fundamental to Both Singing and Pilates
(Including but not limited to)

<table>
<thead>
<tr>
<th>PRIMARY MUSCLES OF THE HEAD, NECK AND FACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Scalenus Anterior, Medius, Posterior 2. Sternocleidomastoideus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIMARY MUSCLES OF THE TRUNK:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Erector Spinae (Sacrospinalis) 2. Multifidus 3. External &amp; Internal Intercostals</td>
</tr>
<tr>
<td>4. Diaphragm 5. External &amp; Internal Obliques</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIMARY MUSCLES OF THE SHOULDER AND UPPER ARM:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SECONDARY MUSCLES OF THE SHOULDER AND UPPER ARM:</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Rhomboids 6. (a) Supraspinatus (b) Infraspinatus, (c) Teres Minor,</td>
</tr>
<tr>
<td>(d) Subscapularis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIMARY MUSCLES OF THE HIP AND THIGH:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PRIMARY MUSCLES OF THE LEG AND FOOT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Soleus 2. Flexor Hallucis Longus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRIMARY MUSCLES OF THE PELVIC FLOOR:</th>
</tr>
</thead>
</table>

89
Methodology Step 2 – Pilates Designed Exercise Routine

Table 2. Pilates Designed Exercise Routine

<table>
<thead>
<tr>
<th>NECESSARY EQUIPMENT</th>
<th>OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mat, small ball (approx. 9 cm), theraband© and big ball (approx. 55 cm)</td>
<td></td>
</tr>
</tbody>
</table>

**IMPORTANT NOTE ABOUT THE BREATH CYCLE**
Every exercise mandates a specific breath pattern in the breath cycle.

<table>
<thead>
<tr>
<th>ROUTINE MAT CLASS WITH PROPS</th>
<th>OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE-PILATES</td>
<td>Education of concepts in alignment: Postural, anatomical and spinal alignment; breathing: expansion of thoracic cage and ROM; focus on muscle strength, endurance and flexibility of intercostals; and joint release by engaging the core/powerhouse.</td>
</tr>
<tr>
<td>SPINE ARTICULATION (SA)</td>
<td>Flexion (bend) and articulation of the spine; ROM of the vertebrae throughout entire spine/vertebral column.</td>
</tr>
<tr>
<td>BODY STRETCHES (STRETCH)</td>
<td>Awareness and lengthening (eccentric contractions) of muscles.</td>
</tr>
<tr>
<td>CORE or POWERHOUSE (C)</td>
<td>Powerhouse focus for strength, flexibility, ROM and muscular endurance.</td>
</tr>
<tr>
<td>BACK EXTENSION (BE)</td>
<td>Strengthening of trunk muscles fundamental in posture and breath management.</td>
</tr>
<tr>
<td>ALTERNATES (ALT)</td>
<td>Further core strengthening exercises and variations on core exercises by targeting muscle groups fundamental to the vocal process.</td>
</tr>
<tr>
<td>THERABAND ARMS</td>
<td>Resistance training and PNF stretching/strengthening/ flexibility in the shoulder girdle.</td>
</tr>
<tr>
<td>SACRAL STRETCH (SAC)</td>
<td>Imprinting concept by releasing quadratus lumborum as primary muscle for stabilizing the pelvis. Spinal awareness and the gravitational pull on it.</td>
</tr>
<tr>
<td>THERABAND LEGS</td>
<td>Resistance training and PNF stretching, strengthening, and flexibility for target muscle groups in the hips and thighs.</td>
</tr>
<tr>
<td>THERABAND FOOTWORK</td>
<td>Resistance training &amp; PNF stretching, strengthening, and flexibility. Focus on the feet.</td>
</tr>
<tr>
<td>BODY STRETCHES</td>
<td>Overall total body, spine and core focus.</td>
</tr>
<tr>
<td>CARDIO OPTION</td>
<td>Warm-up of body and circulation. Respiratory strengthening.</td>
</tr>
</tbody>
</table>
Methodology Step 3 - Modifications

The variations and modifications to exercises specific for singers for the most part, specifically address the differences in eccentric (lengthening) contractions versus concentric (shortening) contractions. The three modifications in the Pilates-based exercises for singers when performing DK Body Balancing Method® of Pilates include:

1. Breathing is initiated by a nose to mouth inhale or forced inspiratory breath. This approach is to help create full expansion of the lungs (goal = maximum vital lung capacity and complemental breath) and maximum ROM of the thoracic cage on the first deep diaphragmatic-abdominal breath. This deep breath must be practiced before shorter percussive breaths can be taken during the same exercise.

2. In the “scapular depression exercise” original to DKBBM Pilates, the student must keep a lengthening of the spine with a focus on the cervical vertebrae during a controlled forced expiratory breath.

3. Arms are at a 45° angle with palms up when applicable in an exercise, to ensure eccentric contraction of the latissimus dorsi upon the inspiratory breath and the controlled forced expiratory breath.
   a) In Pilates-based exercises with the latissimus dorsi eccentrically contracted and sustained through a complete breath cycle, pelvic floor muscles (PF) engage to create variation in range of motion (ROM) in:
      i) In Neutral-spine (N-Spine), pelvic floor (PF) muscles are eccentrically contracted.
      ii) In a Coccyx-curl (C-curve), PF muscles are concentrically contracted.

Repetitions - A minimum of three (3) repetitions of an exercise are mandated by the DK Body Balancing Method of Pilates-based physical training:

1st time: performing the exercise so that the mind can experience it
2nd time: brain and muscles try to understand the exercise
3rd time: the nervous system, brain and muscles learn the exercise

Integrated Method: Level of student based on accuracy of exercise before fatigue:

3 - 5 repetitions = Beginner
6 - 10 repetitions = Intermediate
11 - 15 repetitions = Advanced
16 - 20 repetitions = Expert
> 20 repetitions = the mind is no longer working at its highest efficiency for optimal mind-body conditioning performance

This final “integrated method of Pilates-based exercises for voice performance training” (integrated method) can be both an instructional guideline as well as diagnostic tool for the voice teacher who also has Pilates-based physical training certification. The student should ensure that they follow the steps of the integrated method in the order that they are listed. This is to ensure optimal results and to habituate accurate practice at this beginning level. (Table 3 and Table 4)

Students of singing who practice the integrated method, will have better posture, breath management and a stronger mind-body conditioning therefore improving volition and respiration in their vocal performance. The general overall benefits of these exercises is to create better range of motion (ROM of a joint or bone), flexibility (muscle lengthening without contraction), strength and stamina in the major muscles groups involved in posture and breath management with mind-body conditioning in volition and respiration in the vocal process. Every exercise mandates a specific breath pattern with a deep or forced inspiratory and expiratory breath to begin, and then percussive breaths to follow if necessary, depending on the exercise. The most important variation to a Pilates-based exercise for voice performance training is the eccentric contraction of the latissimus dorsi (“singer lats” Table 3 and Table 4 column 6) during controlled forced expiration.

The integrated method can help train simple mind-body sequencing of coordinated movements with basic breath patterns, to advanced mind-body sequencing with coordinations including the head, the arms and the legs. The exercises that focus on the
legs, hips and thighs, help foundational muscles that create the support for postural improvement and joint release. This support applies to improvement in alignment, symmetry and fluidity of the body.

The integrated method when used as a diagnostic tool can help to identify weaker target muscles, weak mind-body conditioning in certain sequencing, or asymmetry in the body that hinders progress in the study and practice of singing.

* see CHAPTER 6, Methodology Step 4 (Part II) in Chart Form: Table 3 and Table 4. Charts of the Integrated Method of Pilates-based Exercises for Voice Performance Training

Methodology Step 5 – Repetitions of Specific Exercises

See Table 3 or Table 4. Chart of the Integrated Method of Pilates-based Exercises for Voice Performance Training, COLUMN 7: REPETITIONS (REPS)

Methodology Step 6 - Discussion

See Table 4. Chart of the Integrated Method of Pilates-based Exercises for Voice Performance Training, COLUMN 8: BENEFITS FOR SINGERS

Methodology Step 7 – Recommended Schedule

See Recommended Schedule following Table 4, page 124. Chart of the Integrated Method of Pilates-based Exercises for Voice Performance Training
CHAPTER 6

RESULTS AND DISCUSSION OF

METHODOLOGY – PART II

Methodology Step 4 (Part II): The Integrated Method of Pilates-based Exercises

for Voice Performance Training in Chart Form

What follows are the results and discussion of the methodology represented in chart form (Table 3 and Table 4). Column 1 is the order the exercises should be performed. Column 2 is the category of exercise. Column 3 is the area of focus of the exercise according to a Pilates designed exercise routine. Column 4 is the name of the exercise or a short description of the sequence of actions. Column 5 is the traditional regimen for a Pilates student. Column 6 pertains to the regimen that should also be practiced by a student of voice performance with the variation of an eccentric contraction of the latissimus dorsi upon a controlled forced expiratory breath. Columns 5 and 6 are two different regimens (Day #1 and Day #2), and are alternated in the overall regimen for singing students practicing the integrated method. Column 7 specifically lists the number of repetitions necessary for a beginner level student. In Table 4, column 8 is the discussion of the benefits of each exercise for students training for voice performance.
<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP</td>
<td>CATEGORY</td>
<td>AREA OF FOCUS</td>
<td>EXERCISE NAME</td>
<td>Day #1</td>
<td>Day #2</td>
<td>REPS</td>
</tr>
<tr>
<td>1</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Breathing</td>
<td>Reg Lats</td>
<td>Singer Lats †</td>
<td>3x</td>
</tr>
<tr>
<td>2</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Nose Circles with breathing</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each direction</td>
</tr>
<tr>
<td>3</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Mouthwash</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>For a count of 10</td>
</tr>
<tr>
<td>4</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Scapular Depression*</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>5</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Breastbone (Sternum) Breathing</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>6</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Thoracic Softening N-Curve</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>7</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Thoracic Softening C-Curve</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>8</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Pelvic Floor N-Spine Regular</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>9</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Pelvic Floor C-Curve Regular</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>10</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>C-curve Head roll-up</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td></td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>IMPRINTING – see Sacral Stretches</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Joint Release Knee Rocking</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td>Knee Stirring</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Small Ball Exercises</td>
<td>SA</td>
<td>Bridging – Double Leg &amp; Single Leg</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x double leg 10x single leg 5x each side</td>
</tr>
<tr>
<td>14</td>
<td>Small Ball Exercise (can be Mat Exercise)</td>
<td>SA</td>
<td>Roll-up</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
</tbody>
</table>

* DK Body Balancing Original Exercise
† The Olympic Singer Original Variation
Table 3. Chart Summary of the Integrated Method of Pilates-based Exercises for Voice Performance Training

<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP</td>
<td>CATEGORY</td>
<td>AREA OF FOCUS</td>
<td>EXERCISE NAME</td>
<td>Day #1</td>
<td>Day #2</td>
<td>REPS</td>
</tr>
<tr>
<td>15</td>
<td>Mat Exercises</td>
<td>SA/ ALT/stretch</td>
<td>Rolling</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>16</td>
<td>Small Ball Exercises</td>
<td>C</td>
<td>Adduction – Neutral Spine</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x slow, 15x fast</td>
</tr>
<tr>
<td>17</td>
<td>Small Ball Exercises</td>
<td>C</td>
<td>Adduction – C-Curve</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x slow, 15x fast</td>
</tr>
<tr>
<td>18</td>
<td>Small Ball</td>
<td>C</td>
<td>Obliques-Neutral Spine</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each side</td>
</tr>
<tr>
<td>19</td>
<td>Small Ball</td>
<td>C</td>
<td>Obliques – C-curve</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each side</td>
</tr>
<tr>
<td>20</td>
<td>Mat Exercises</td>
<td>C Thoracic Spine Rotation/Obliques T12 on LL</td>
<td>Elbow to Knee Precursor</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x and 5x</td>
</tr>
<tr>
<td>21</td>
<td>Mat Exercises</td>
<td>C</td>
<td>Coordination (Long)</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>22</td>
<td>Mat Exercises</td>
<td>C</td>
<td>Coordination (short)</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>15x</td>
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<tr>
<td>23</td>
<td>Mat Exercises</td>
<td>C</td>
<td>Leg Circles</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each direction and total 10x each leg</td>
</tr>
<tr>
<td>24</td>
<td>STRETCH</td>
<td>STRETCH</td>
<td>Knees to Chest</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Hold for 30 sec</td>
</tr>
<tr>
<td>25</td>
<td>STRETCH</td>
<td>STRETCH</td>
<td>Sit back on feet (or small ball)</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Hold for 30 sec</td>
</tr>
<tr>
<td>26</td>
<td>STRETCH</td>
<td>STRETCH</td>
<td>Lumbar stretch with foot on knee and head in opposite direction</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Hold for 30 each side</td>
</tr>
<tr>
<td>27</td>
<td>Big Ball/Good BE assisted 1st one</td>
<td>BE assisted</td>
<td>Wheel Barrow</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>28</td>
<td>Mat Exercises</td>
<td>ALT</td>
<td>Bicycle</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Set of 4 reps Inhal inhale then exhale exhale 15x</td>
</tr>
<tr>
<td>29</td>
<td>Small Ball</td>
<td>BE</td>
<td>Hip extension – Parallel</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Up 5x slowly and then squeeze 5x or 10x</td>
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</table>
Table 3. Chart Summary of the Integrated Method of Pilates-based Exercises for Voice Performance Training

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<tr>
<td>STEP</td>
<td>CATEGORY</td>
<td>AREA OF FOCUS</td>
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<td>Day #1</td>
<td>Day #2</td>
<td>REPS</td>
</tr>
<tr>
<td>30</td>
<td>Sidekicks</td>
<td>ALT</td>
<td>Sidekicks Front/Back</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>31</td>
<td>Small Ball - Prone</td>
<td>BE</td>
<td>Back Extension</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>32</td>
<td>Small Ball-Leg work</td>
<td>ALT</td>
<td>Corkscrew</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>33</td>
<td>Mat Exercise</td>
<td>BE</td>
<td>Swan 1</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>34</td>
<td>Mat Exercise</td>
<td>ALT/oblique BEG/INT</td>
<td>Can Can</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>6 sets</td>
</tr>
<tr>
<td>35</td>
<td>Small Ball-Leg work</td>
<td>OR</td>
<td>Adduction &amp; Oblique/Lat</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x slow, 15x fast</td>
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<tr>
<td>36</td>
<td>Mat Exercise</td>
<td>BE</td>
<td>Single Hamstring</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each side</td>
</tr>
<tr>
<td>37</td>
<td>ADV</td>
<td>SA/ALT</td>
<td>Rollover</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>38</td>
<td>Mat Exercise</td>
<td>BE</td>
<td>Swimming</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>4x in, in, in, out, out, out, 5 sets</td>
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<tr>
<td>39</td>
<td>Theraband Arms - S.I.T.S.</td>
<td>ALT</td>
<td>S.I.T.S. internal rotation</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>40</td>
<td>Theraband Arms - S.I.T.S.</td>
<td>ALT</td>
<td>S.I.T.S. Abduction</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>41</td>
<td>Theraband Arms - S.I.T.S.</td>
<td>ALT</td>
<td>S.I.T.S. Abduction</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>42</td>
<td>Theraband Arms - S.I.T.S.</td>
<td>OR</td>
<td>S.I.T.S. External rotation</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>43</td>
<td>Theraband Seated</td>
<td>ALT</td>
<td>Crack the Walnut</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>STEP</td>
<td>CATEGORY</td>
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<td>EXERCISE NAME</td>
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<td>REPS</td>
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</tr>
<tr>
<td>44</td>
<td>Theraband</td>
<td>ALT</td>
<td>Bow and Arrow</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
</tr>
<tr>
<td>44</td>
<td>Small Ball-</td>
<td>ST SAC</td>
<td>Scissors/ Hip Flexor Stretch</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Slow rocking movements not over 6 sets Hold for 30 seconds</td>
</tr>
<tr>
<td>45</td>
<td>Small Ball-</td>
<td>ST SAC</td>
<td>Small Circles</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x in each direction</td>
</tr>
<tr>
<td>46</td>
<td>Small Ball-</td>
<td>ST SAC</td>
<td>Adduction-Parallel</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>47</td>
<td>Small Ball-</td>
<td>ST SAC</td>
<td>Adduction-External Rotation (c-curve only)</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>48</td>
<td>Theraband</td>
<td>ALT/</td>
<td>Single Leg-Bend/Straighten</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>4x hold for 30 seconds each side</td>
</tr>
<tr>
<td>49</td>
<td>Theraband</td>
<td>ALT/Stretch</td>
<td>Adductor stretch</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Hold for 30 seconds each side</td>
</tr>
<tr>
<td>50</td>
<td>Theraband</td>
<td>ALT Stretch</td>
<td>I.T. Band Stretch</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Hold for 30 secs</td>
</tr>
<tr>
<td>51</td>
<td>Theraband</td>
<td>ALT/C</td>
<td>Leg Circles</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x or 4x each direction 8x total on each side</td>
</tr>
<tr>
<td>52</td>
<td>Theraband</td>
<td>Foot STRETCH</td>
<td>Double Legs-Dorsi/Plantar Flexion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x reg / 10x toes</td>
</tr>
<tr>
<td>53</td>
<td>Theraband</td>
<td>Foot STRETCH</td>
<td>Single Leg-Dorsi/Plantar Flexion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x reg / 10x toes</td>
</tr>
<tr>
<td>54</td>
<td>Theraband</td>
<td>ALT/</td>
<td>Double leg-bend/straighten</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>4x and then 30 second hold</td>
</tr>
<tr>
<td>55</td>
<td>Theraband</td>
<td>Foot STRETCH</td>
<td>Circumduction</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each foot</td>
</tr>
<tr>
<td>56</td>
<td>Theraband</td>
<td>Foot STRETCH</td>
<td>Inversion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>10x each foot</td>
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</table>
Table 3. Chart Summary of the Integrated Method of Pilates-based Exercises for Voice Performance Training

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<td>STEP</td>
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<td>AREA OF FOCUS</td>
<td>EXERCISE NAME</td>
<td>Day #1</td>
<td>Day #2</td>
<td>REPS</td>
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<tr>
<td>57</td>
<td>Theraband</td>
<td>Foot Stretch</td>
<td>Eversion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>10x each foot</td>
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<tr>
<td></td>
<td>Footwork</td>
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<td></td>
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<tr>
<td>58</td>
<td>Theraband</td>
<td>DORSI STRETCH</td>
<td>Dorsi Flexion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
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</tr>
<tr>
<td></td>
<td>Footwork</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Stretches</td>
<td>ALT / STRETCH</td>
<td>Saw</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>10x</td>
</tr>
<tr>
<td>60</td>
<td>Stretches</td>
<td>STRETCH</td>
<td>Spine Stretch—seated roll-up</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x or 4x</td>
</tr>
<tr>
<td>61</td>
<td>Stretches</td>
<td>STRETCH</td>
<td>Standing Roll-Down</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
</tr>
<tr>
<td>62</td>
<td>Big Ball</td>
<td>Stretch the back</td>
<td>Prone Stretch (stomach)</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>30 secs</td>
</tr>
<tr>
<td>63</td>
<td>Big Ball</td>
<td>Stretch the front</td>
<td>Supine Stretch (back)</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>30 secs</td>
</tr>
<tr>
<td>64</td>
<td>Big Ball</td>
<td>CARDIO (1 minute each)</td>
<td>Sit on Big Ball</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>1 minute per exercise</td>
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<td>BABY BOUNCES</td>
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<td></td>
<td></td>
<td></td>
<td>ARM SWINGS</td>
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<td></td>
<td></td>
<td></td>
<td>RUNNING</td>
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<td></td>
<td></td>
<td></td>
<td>JUMPING JACK LEGS</td>
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<tr>
<td></td>
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<td></td>
<td>RUSSION KICKS (ARMS ACROSS CHEST)</td>
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<td></td>
<td>SKIER</td>
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<td></td>
<td>STARBUST 12341</td>
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Table 4. Chart of the Integrated Method of Pilates-based Exercises for Voice Performance Training with Benefits for Singers

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<thead>
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<td>STEP</td>
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<td>AREA OF</td>
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<td>Day</td>
<td>Day</td>
<td>REPS</td>
<td>BENEFITS FOR SINGERS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FOCUS</td>
<td></td>
<td>#1</td>
<td>#2</td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Breathing (Breathing)</td>
<td>Reg Lats (latissimus)</td>
<td>Singer Lats† (latissimus)</td>
<td>3x</td>
<td>• Awareness of body orientation with respect to symmetry while in supine position.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inspiratory breath through the nose to mouth then expiratory breath through the mouth with pursed mouth.†</td>
<td>(concentric on expiration)</td>
<td>(eccentric on expiration)</td>
<td></td>
<td>• Awareness of body response to breathing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and</td>
<td>and</td>
<td></td>
<td></td>
<td>• Development of teacher-student relationship and communication style.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Singer Lats</td>
<td>Reg Lats</td>
<td></td>
<td>3x</td>
<td>(e.g. verbal, visual and/or manual assistance cues).</td>
</tr>
<tr>
<td>2</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Nose Circles with breathing</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each direction</td>
<td>• Respiratory strengthening with diaphragm focus.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and</td>
<td>and</td>
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</table>

† The Olympic Singer Original Variation
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<tbody>
<tr>
<td>3</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Mouthwash</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td></td>
<td>• Joint release and release of tension in the temporomandibular joint while performing breathing exercises.</td>
</tr>
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<td></td>
<td>* Scapular Depression* &lt;br&gt;Arms at a 45° with palms facing up. A shoulder shrug on the inspiratory breath then the extreme opposite action with the shoulders on the forced controlled expiratory breath.</td>
</tr>
<tr>
<td>4</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Scapular Depression*</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x</td>
<td>• Shoulder girdle ROM and stability with latissimus dorsi focus (note: scapular depression is initiated by the latissimus dorsi). &lt;br&gt;• Awareness of abdominal recruitment with inner and outer core.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Singer Lats</td>
<td>Reg Lats</td>
<td>3x</td>
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* DK Body Balancing Original
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<td>BENEFITS FOR SINGERS</td>
</tr>
</tbody>
</table>
| 5        | Pre-Pilates | PRE | Breastbone (Sternum) Breathing | Reg Lats | Singer Lats | 3x | 3x | • Expansion of ribcage and relationship to sternum and shoulder girdle  
|          |          |      | Forced Inspiratory breath through the nose to mouth while feeling a filling up of the ribcage which raises the sternum, then the continued inspiratory breath will involve a scapular lift and separation; the expiration is through the mouth. |          |          |      |          | • ROM of the thoracic cage creating room for the lungs and awareness of thoracic expansion with spinal alignment. |
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<th>Day #2</th>
<th>REPS</th>
<th>BENEFITS FOR SINGERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td><strong>Thoracic Softening</strong></td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>3x 3x</td>
<td>• Awareness of powerhouse muscles during ‘billowing affect’ of the thoracic cage.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td><strong>Neutral Spine (N-Spine)</strong></td>
<td></td>
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<td>• Creating ROM in thoracic cage while allowing the body to respond to the breath</td>
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<td>and therefore developing a stronger mind-body connection to related proprioceptive</td>
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<td></td>
<td></td>
<td>muscles.</td>
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<td>• A 3-dimensional breath (all around the body) including movement in the thoracic</td>
</tr>
<tr>
<td></td>
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<td>spine and awareness of the powerhouse.</td>
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<td>• On the expiratory breath, the funneling of the ribs to a closed position</td>
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<td>recruiting support from the lower abdominal muscles.</td>
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<td>• Increases ability to maintain natural lumbar curve in the spine while allowing</td>
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<td>the body to respond to the breath</td>
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<td>• Diaphragm, TrA and lumbar multifidus flexibility, and thoracic cage ROM.</td>
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Table 4. Chart of the Integrated Method of Pilates-based Exercises for Voice Performance Training with Benefits for Singers

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| 7    | Pre-Pilates | PRE          | Thoracic Softening C-Curve | Reg Lats | Singer Lats | 3x 3x | • Creating ROM in thoracic cage while allowing the body to respond to the breath and therefore developing a stronger mind-body connection to related proprioceptive muscles.  
• A 3-dimensional breath (all around the body) including movement in the thoracic cage and spine and awareness of the powerhouse.  
• On the expiratory breath, the funneling of the ribs to a closed position recruiting support from the lower abdominal muscles.  
• Diaphragm, TrA and lumbar multifidus flexibility, and thoracic cage ROM.  
• Spinal L1 to L3 vertebral ROM and associated lumbar multifidus flexibility and strengthening for better breath management.  
• Connection to PF muscles, increase ROM of thoracic cage, increase in diaphragm and TrA flexibility and strength.  
• Increasing awareness of body’s response to controlled forced inspiratory and expiratory breathing. |
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<tr>
<td>8</td>
<td>Pre-Pilates</td>
<td>PRE</td>
<td>Pelvic Floor N-Spine Regular</td>
<td>Reg Lats Singer Lats</td>
<td>Singer Lats Reg Lats</td>
<td>3x</td>
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| 9    | Pre-Pilates | PRE | Pelvic Floor C-Curve Regular Forced inspiratory breath through the nose to mouth then controlled forced expiration through the mouth. | Reg Lats Singer Lats | Singer Lats Reg Lats | 3x 3x | • Increase in ROM of L1-L3 spinal vertebrae with associated lumbar multifidus strengthening.  
  • Flexibility and strengthening in the external/internal intercostals.  
  • Connection to PF muscles and diaphragm flexibility and strengthening.  
  • Improved engagement of the powerhouse with deep abdominal recruitment and transversus abdominis (TrA) focus. |
| 10   | Pre-Pilates | PRE | Head roll-up C-curve without eccentrically contracting the Latissimus Dorsi on the expiratory breath Note: if spine is rigid then practice spine articulation exercises for more flexibility | Reg Lats Singer Lats | Singer Lats Reg Lats | 3x | • Eccentrically contracting the SCM and the Scalenus releasing pressure on the larynx.  
  • Lengthening in the cervical of the spine.  
  • Increased flexibility, strength and stamina with connection to PF muscles, and diaphragm.  
  • Deep abdominal recruitment and TrA in the powerhouse.  
  • C-Curve increased flexibility, strength and stamina of L1 to L3 vertebrae. |
| Pre-Pilates | PRE | Imprinting – see Sacral Stretches | | | | | |
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| 11       | Pre-Pilates | PRE | Knee Rocking | Reg Lats | Singer Lats | 3x each side | • First time student learns to initiate movement of the leg by stabilizing with the powerhouse.  
• Joint release exercise. |
| 12       |           |       | Knee Stirring | Reg Lats | Singer Lats | 5x inward 5x outward | • Powerhouse as stabilizer that stays engaged during leg circles both on inward and outward movement for improved hip joint release.  
• Analogy to 'bowl and spoon' motion for release of joint. |
| 13       | Small Ball Exercises (can be a Mat only Exercise) | SA | Bridging – Double Leg & Single Leg | Reg Lats | Singer Lats | 3x and 10x single legs – 5x each side | • Advanced sequencing exercise improving mind-body connection introspectively (inside) the body.  
Note: hamstrings pull up versus glutes pushing up (or squeezing first).  
• N-spine to C-curve therefore increasing flexibility strength and stamina by engaging the glutes, then the hamstrings and the muscles of the pelvis.  
• Improved stabilization of trunk on pelvis and hips.  
• Connection between the lumbar multifidus, abdominals, and pelvic floor. |
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</table>
| 14       | Small Ball Exercise (can be a Mat Only Exercise) | SA       | Roll-up  | Reg Lats | Singer Lats | 5x       | - Improved flowing movement while always sequencing.  
- Both a mentally and physically challenging exercise.  
- Focus on SCM strengthening.  
- Focus on spine flexion and stable trunk on pelvis.  
- Improved controlled breathing and breath management by integration of a full body action during inspiratory breath and then also on the controlled expiratory breath. |
| 15       | Mat Exercises | SA/ ALT/ stretch | Rolling  | Reg Lats | Singer Lats | 5x       | - Stretching thoracic and lumbar spine.  
- Increasing ROM of spinal vertebrae.  
- Focus on SCM strengthening.  
- Spine flexion, stable trunk on pelvis while all the time engaging the powerhouse. |
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<tr>
<td>16</td>
<td>Small Ball Exercises</td>
<td>C</td>
<td>Adduction – Neutral Spine</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x slow 15x with short breaths</td>
<td>• Awareness and strengthening adductor muscles. (note: most students have low awareness of adductor muscles)</td>
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<td>• Connection of secondary muscles, including the multifidus, abdominals and PF, that are fundamental in helping stabilization for posture when standing.</td>
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<td>• Adductors are fundamental in assisting PF muscles because of their associated connection.</td>
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<td>• Renewal of breath from a deep diaphragmatic breath to percussive breaths. Improvement of strength and stamina in breath management.</td>
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<td>• Increased mind-body strengthening and conditioning.</td>
</tr>
<tr>
<td>17</td>
<td>Small Ball Exercises</td>
<td>C</td>
<td>Adduction – C-Curve</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x slow 15x fast</td>
<td>• Increased ROM in the thoracic cage, and increased strength and stamina of diaphragm and TrA while using a controlled breath on forced inspiration and expiration.</td>
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</table>
| 18       | Small Ball | C | Obliques-Neutral Spine | Reg Lats | Singer Lats | 5x each side | • Alternating sides creates symmetry and increased strength and stamina in the external and internal obliques.  
• Spinal rotation and dissociation of upper torso (thoracic cage) and pelvis including rotation on the T12-L1 vertebrae.  
• Stabilizing of ribcage with intercostals contraction.  
• Overall powerhouse strengthening necessary for spine stability during controlled forced inspiration and expiration in breath management. |
| 19       | Small Ball | C | Obliques – C-curve | Reg Lats | Singer Lats | 5x each side | • Alternating sides creates symmetry and increased strength and stamina in the external and internal obliques.  
• External and internal obliques Spinal rotation and dissociation of upper torso(thoracic cage) and pelvis. Overall powerhouse strengthening necessary for spine stability during controlled forced inspiration and expiration in breath management.  
• Increased ROM lumbar vertebrae increasing strength and stamina of associated muscles of the lumbar and thoracic spine. |
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<tr>
<td>20</td>
<td>Mat Exercises</td>
<td>C Thoracic Spine Rotation/Obliques T12 on L1</td>
<td>Elbow to Knee precursor, Elbow to Knee</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x and 5x</td>
<td>• Dissociation of shoulder girdle from pelvic girdle keeping each one stabilized. Spine rotation on the T12-L1 vertebrae with oblique/abdominal control while all the time engaging the major muscles of the Powerhouse. &lt;br&gt; • Dynamic connection and strengthening of the adductor and oblique muscle systems. &lt;br&gt; • Oblique, intercostals and adductors support gait efficiency (i.e. standing posture and movement).</td>
</tr>
<tr>
<td>21</td>
<td>Mat Exercises</td>
<td>C</td>
<td>Coordination (Long)</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
<td>• Powerhouse focus with secondary work to increase strength and stamina of adductor muscles.</td>
</tr>
<tr>
<td>22</td>
<td>Mat Exercises</td>
<td>C</td>
<td>Coordination (short)</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>15x</td>
<td>• Percussive breaths creating stamina for renewal of breath based on use of the powerhouse and adductor muscles. Adduction and Abduction</td>
</tr>
<tr>
<td>23</td>
<td>Mat Exercises</td>
<td>C</td>
<td>Leg Circles</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each direction and total 10x each leg</td>
<td>• ROM of hips joint and creating improved agility for balance. &lt;br&gt; • Hip socket joint release as well as pelvic girdle stability for posture. &lt;br&gt; • All the time, engaging the powerhouse.</td>
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| 24       | STRETCH  | STRETCH   | Knees to Chest | Reg Lats | Singer Lats | Hold for 30 sec | • Releasing tension in muscles in the lumbar spine area including the erector spinae.  
  • Increasing flexibility in supine position, holding knees to chest without recruitment of the core so that there is a stretch and release in the back and spine. |
| 25       | STRETCH  | STRETCH   | Sit back on feet (or small ball) | Reg Lats | Singer Lats | Hold for 30 sec | • “Child pose,” a traditional Pilates resting position.  
  • Different way from being in supine position for spine flexion.  
  • To stretch the latissimus dorsi and release muscles of the lumbar. |
| 26       | STRETCH  | STRETCH   | Lumbar stretch with foot on knee - head opp. direction | Reg Lats | Singer Lats | Hold for 30 each side | • Stretching abductor-aspect of hip and leg for increased flexibility. |
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| 27   | Big       | BE assisted   | Wheel Barrow  | Reg Lats | Singer Lats | 3x   | • Good for foundational strengthening.  
      | Ball/good |               |               |        |        |      | • Primary: strengthening the PF and fluidity in the torso i.e. pelvic girdle stability.  
      | first exercise |           |               |        |        |      | • Good precursor to back extension exercises because the ball helps continue recruitment of the core/powerhouse with the pubic bone pressing into the ball during the back extension.  
      |           |               |               |        |        |      | • Reduces injury in reeducation of mind-body coordinations.  
      |           |               |               |        |        |      | • Increases ROM of the vertebral column by lengthening it so that there is more flexibility in the thoracic cage. |
| 28   | Mat       | ALT           | Bicycle C-curve | Reg Lats | Singer Lats | Set of 4x Inhale inhale then exhale exhale 15x one side | • Awareness and improvement of a complex sequencing pattern while all the time engaging the powerhouse.  
      | Exercises |               |               |        |        |      | • Improvement in hip flexor strengthening i.e. the iliopsoas with eccentric contraction.  
      |           |               |               |        |        |      | • Dynamic stability via the abdominals and deep lateral muscles with thoracic extension. |
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<tr>
<td>29</td>
<td>Small Ball</td>
<td>BE</td>
<td>Hip extension – Parallel</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>Up 5x slowly and then squeeze 5x or 10x</td>
<td>• Improvement of back extension with recruitment of powerhouse supported by hip muscles (rather than lifting from knees).</td>
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<td>30</td>
<td>Sidekicks</td>
<td>ALT</td>
<td>Sidekicks Front/Back</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
<td>• Abductor strengthening during Note: During the exercise, ribcage must stay lifted off the ground with the shoulder girdle stable (latissimus dorsi contracted) while expansion of the ribcage during leg movements.</td>
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<tr>
<td>31</td>
<td>Small Ball - Prone</td>
<td>BE</td>
<td>Back Extension</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
<td>• Increase ROM of lumbar and thoracic vertebrae. • Basic spine stretch in prone position.</td>
</tr>
<tr>
<td>32</td>
<td>Small Ball - Leg work</td>
<td>ALT</td>
<td>Corkscrew</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
<td>• Focus on (1) abdominals eccentrically and (2) adductors concentrically. • Dynamic movement of the TrA • Advanced supine position core exercise working on stable pelvis, engagement of the powerhouse, deep diaphragmatic breath and ability to release tension in the neck or shoulders.</td>
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| 33       | Mat      | BE       | Swan I    | Reg Lats | Singer Lats | 5x       | • Back extension of lumbar and thoracic spine/vertebrae for breath management.  
• Eccentric contraction of the powerhouse on the back extension.  
• Important variation breathing pattern with an opposite sequence.  
• Goal to keep shoulder girdle stable on exhale to mimic singing posture or controlled forced expiratory breath. |
|          | Exercises|          |           |          |          |          |          |
| 34       | Mat      | ALT/     | Can Can   | Reg Lats | Singer Lats | In in in rocking ex ex kick 6 sets | • C-Curve and focus on oblique abdominals improving strength and stamina.  
• Rhythmic breathing pattern (with percussive breaths) after deep diaphragmatic breath is taken; creating flexibility in breath management. |
|          | Exercises| oblique  |           |          |          |          |          |
|          |          | BEG/INT  |           |          |          |          |          |
| 35       | Small Ball-Leg work | Advanced | Adduction & Oblique/Lat | Reg Lats | Singer Lats | 5x slow 15x fast | • Works on separate sides of the body to create symmetry and increase flexibility, strength and stamina of the obliques and latissimus dorsi.  
• Working with both deep breath and percussive breaths. |
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| 36   | Mat Exercise | BE            | Single Hamstring | Reg Lats | Singer Lats | 5x each side | • Improvement in foundational for posture.  
• ROM motion in the hip joint and increased flexibility in the hamstring while engaging the powerhouse so to not ‘grab’ the muscle (same action in singing) |
| 37   | ADV      | SA/ALT        | Rollover      | Reg Lats | Singer Lats | 3x | • Primary focus: increasing ROM in thoracic spine.  
• Secondary focus is improved spinal articulation. |
| 38   | Mat Exercise | BE            | Swimming      | Reg Lats | Singer Lats | 4x in in out out out of 5 sets | Reminder: 1st - head 2nd - legs 3rd - arms |
|      |          |               |               |         |         |      | • Advanced sequencing activity and full integration of Pilates concepts improving mind-body strengthening and conditioning.  
• Percussive or rhythmic breathing while engaging the powerhouse and also recruiting movement in the arms and legs. (added arms and legs are considered a complex activity). |
| 39   | Theraband | ALT           | S.I.T.S. internal rotation | Reg Lats | Singer Lats | 5x | • Shoulder girdle stability and ROM because of strengthening rotator cuff muscles. |
| 40   | Theraband | ALT           | S.I.T.S. Abduction | Reg Lats | Singer Lats | 5x | • Shoulder girdle stability and ROM because of strengthening rotator cuff muscles. |
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<td>41</td>
<td>Theraband Arms – S.I.T.S.</td>
<td>ALT</td>
<td>S.I.T.S. Adduction</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
<td>• Shoulder girdle stability and ROM because of strengthening rotator cuff muscles.</td>
</tr>
<tr>
<td>42</td>
<td>Theraband Arms – S.I.T.S.</td>
<td>ALT</td>
<td>S.I.T.S. External rotation</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
<td>• Shoulder girdle stability and ROM because of strengthening rotator cuff muscles.</td>
</tr>
<tr>
<td>43</td>
<td>Theraband Seated</td>
<td>ALT</td>
<td>Crack the Walnut</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x</td>
<td>• Improved eccentric contraction of the trapezius muscle, the pectoralis muscles, and the latissimus dorsi muscles in N-spine, while working the powerhouse and keeping controlled breath management.</td>
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| 44       | Theraband Seated | ALT | Bow and Arrow | Reg Lats | Singer Lats | 5x | • Eccentrically contracting the Trapezius muscle, the pectoralis muscles, and the latissimus dorsi muscles plus scapular ROM with spine rotation on the T12-L1 vertebrae.  
• Overall shoulder girdle stability.  
• Trunk and oblique abdominal challenge. |
Table 4. Chart of the Integrated Method of Pilates-based Exercises for Voice Performance Training with Benefits for Singers

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<tr>
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</table>
| 45   | Small Ball- Sacrum | ST SAC | Scissors/Hip Flexor Stretch | Reg Lats | Singer Lats | Slow rocking movements not over 6 sets Hold for 30 seconds | - Improvement of releasing the Quadratus lumborum and multifidus and working the powerhouse to stabilize the pelvic girdle from the posterior side.  
- Helps in awareness of spinal "imprinting." |
| 46   | Small Ball- Sacrum | ST SAC | Small Circles | Reg Lats | Singer Lats | 5x in each direction | - Improvement of releasing the Quadratus lumborum and multifidus and working the powerhouse to stabilize the pelvic girdle from the posterior side.  
- Helps in awareness of spinal "imprinting." |
| 47   | Small Ball- Sacrum | ST SAC | Adduction-Parallel | Reg Lats | Singer Lats | 3x | - Improvement of releasing the Quadratus lumborum and multifidus and working the powerhouse to stabilize the pelvic girdle from the posterior side.  
- Focus on adductors, tenor fasciae latae, gracilis and pectineus.  
- Helps in awareness of spinal "imprinting." |
| 48   | Small Ball- Sacrum | ST SAC | Adduction-External Rotation (c-curve only) | Reg Lats | Singer Lats | 3x | - Improvement of releasing the Quadratus lumborum and multifidus and working the powerhouse to stabilize the pelvic girdle from the posterior side. |
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</table>
| 48       | Theraband Legs | ALT | Single Leg-Bend/Straighten | Reg Lats | Singer Lats | 4x then hold for 30 seconds each side | • Creating flexibility with increased ROM in leg joints that results in increased strength of the leg muscle focus of the exercise.  
• Stretches hamstring and opens the back of the knee increasing flexibility and improving flowing movement. |
| 49       | Theraband Legs | ALT/Stretch | Adductor stretch | Reg Lats | Singer Lats | Hold for 30 seconds each side | • Creating flexibility with increased ROM in leg joints that results in increased strength of the leg muscle focus of the exercise.  
• Stretches adductors while stretching other leg muscles. |
| 50       | Theraband Legs | ALT/Stretch | I.T. Band Stretch | Reg Lats | Singer Lats | Hold for 30 seconds | • Creating flexibility with increased ROM in leg joints that results in increased strength of the leg muscle focus of the exercise.  
• Stretches I.T. band. |
| 51       | Theraband Legs | ALT/C | Leg Circles | Reg Lats | Singer Lats | 3x or 4x each direction 8x total on each side | • Creating flexibility with increased ROM in leg joints that results in increased strength of the leg muscle focus of the exercise. |
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</tr>
<tr>
<td>52</td>
<td>Theraband Legs</td>
<td>Foot STRETCH</td>
<td>Double Legs-Dorsi/Plantar Flexion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x feet and then 10x just toes</td>
<td>• Creating flexibility with increased ROM in foot joints that result in increased strength of the muscles of the leg and foot that are in focus in the exercise.</td>
</tr>
<tr>
<td>53</td>
<td>Theraband Legs</td>
<td>Foot STRETCH</td>
<td>Single Leg-Dorsi/Plantar Flexion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x feet and then 10x just toes</td>
<td>• Creating flexibility with increased ROM in foot joints that result in increased strength of the muscles of the leg and foot that are in focus in the exercise.</td>
</tr>
<tr>
<td>54</td>
<td>Theraband Legs</td>
<td>ALT</td>
<td>Double leg-bend/straighten</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>4x and then 30 second hold</td>
<td>• Creating flexibility with increased ROM in leg joints that results in increased strength of the leg muscle focus of the exercise. Stretches hamstring and opens the back of the knee increasing flexibility and improving flowing movement.</td>
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<tr>
<td>55</td>
<td>Theraband Footwork</td>
<td>Foot STRETCH</td>
<td>Circumduction</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>5x each foot</td>
<td>• Creating flexibility with increased ROM in feet and toe joints that result in increased strength of the muscles of the feet that are in focus in the exercise.</td>
</tr>
<tr>
<td>56</td>
<td>Theraband Footwork</td>
<td>Foot STRETCH</td>
<td>Inversion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>10x</td>
<td>• Creating flexibility with increased ROM in feet and toe joints that result in increased strength of the muscles of the feet that are in focus in the exercise.</td>
</tr>
<tr>
<td>57</td>
<td>Theraband Footwork</td>
<td>Foot Stretch</td>
<td>Eversion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td>10x</td>
<td>• Creating flexibility with increased ROM in feet and toe joints that result in increased strength of the muscles of the feet that are in focus in the exercise.</td>
</tr>
<tr>
<td>58</td>
<td>Theraband Footwork</td>
<td>DORSI STRETCH</td>
<td>Dorsi Flexion</td>
<td>Reg Lats</td>
<td>Singer Lats</td>
<td></td>
<td>• Creating flexibility with increased ROM in feet and toe joints that result in increased strength of the muscles of the feet that are in focus in the exercise.</td>
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| 59   | Stretches | ALT/STRETCH   | Saw           | Reg Lats | Singer Lats | 10x  | - An advanced and full integration exercise of posture, breath management and mind-body conditioning.  
- Stretches Quadratus lumborum, needs increased recruitment and control of powerhouse muscles especially the obliques. |
| 60   | Stretches | STRETCH       | Spine Stretch – seated roll-up | Reg Lats | Singer Lats | 3x or 4x | - Stretching from the cervical vertebrae to the coccyx of the spine and increasing ROM.  
- Increasing awareness and ability to isolate independent vertebrae during roll-down on exhale. (Begin with inhale in N-spine). |
| 61   | Stretches | STRETCH       | Standing Roll-Down | Reg Lats | Singer Lats | 3x   | - Integrating sequencing from the very first step in the workout in pre-Pilates Inhale prep, exhale roll down vertebrae by vertebrae opening up the back increasing awareness of parts of the spinal column from cervical, to thoracic, lumbar and coccyx area of the powerhouse. |
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</tr>
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</table>
| 62   | Big Ball | Stretch the back | Prone Stretch (stomach) | Reg Lats | Singer Lats | 30 secs | • Creating flexibility for ROM that results in increased strength.  
• Stretching the back for increased flexibility and strength.  
• Spine flexion and expansion of the intercostals. |
| 63   | Big Ball | Stretch the front | Supine Stretch (back) | Reg Lats | Singer Lats | 30 secs | • Stretching the front of the body.  
• Necessary exercise after several powerhouse and core focus exercises.  
• Opens up the TrA and superficial abdominals. |
| 64   | Big Ball | CARDIO (1 minute each) | Sit on Ball BABY BOUNCES ARM SWINGS RUNNING JUMPING JACK LEGS RUSSIAN KICKS (ARMS ACROSS CHEST) SKIER STARBUST 12341 | Reg Lats | Singer Lats | 1 minute per exercise | • For TESTING OR CONDITIONING:  
• Diagnostic tool to see if PF muscles (Powerhouse muscles) are being recruited as well as training for Increased flexibility. |
Methodology Step 7 – Recommended Schedule

Recommendations for how often the integrated voice performance training method of Pilates-based exercises should be performed on a daily or weekly schedule for new students:

For optimal results with the integrated method, as mandated by Pilates-based physical training methods and DKBBM, the student should practice Program Day #1 and Program Day #2 by alternating them for a minimum of at least twice a week for a total of 4 workouts per week and for as little as three (3) weeks to start; and a maximum of up to 3 times a week at 6 workouts per week and at 6 weeks to start.

This is a beginning level program. The number of workouts can stay consistent, but with the improvement of the exercises, the number of repetitions can be increased. Please refer to chart of levels in Figure 6.
CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

Conclusion

... we must be willing to modify what we do know as information expands. ...Above all, as teachers of singing in a scientific age, we must ask ourselves how much we really know about the subject matter we deal with. Do we have the facts, or do we rely on anecdotal opinions? Do we know the literature of our own field, as well as that of related fields?"

Richard Miller, “The Singing Teacher in the Age of Voice Science” 307

Figure 6: Singer’s Training – Two Choices

![Diagram of Singer’s Training – Two Choices]

If target goals achieved =
Stamina (sing longer)
strength (sing louder)
Correct & Controlled Breathing

Target goals of good posture, correct breathing, and biomechanics are not sufficiently defined by teachers and singers

Determined Level: subjective > objective

Level based on accuracy of exercise before fatigue:
3 – 5 repetitions = Beginner
6 – 10 repetitions = Intermediate
11 – 15 repetitions = Advanced
16 – 20 repetitions = Expert

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Pilates exercises have specific objectives that can directly benefit singers’ objectives in their study and practice of singing. A Pilates-based method of training can add to the way a singer trains (See Figure 6). The student can choose to remain with PNF-based vocal exercises for volition and respiration where teachers and pedagogues determine the level of a singer through more subjective than objective traditions. This subjective assessment is usually because the target goals for these exercises are vague and ill-defined. However, if a singer applies PNF-based Pilates exercises to their training, and if the specified target goals are achieved, then the singer will have greater stamina (be able to sing longer), more strength (sings louder) and correct and optimal breath management for singing with skilled mind-body conditioning.

A singer’s level of training can also be measured by a scale based on the repetitions of an exercise completed before fatigue (Figure 6). A method of Pilates-based exercises is an ideal regimen for singers to focus on to improve posture, breath management and mind-body conditioning related to volition and respiration in the vocal process. Pilates-based exercises have relevance to the study and practice of singing. Thus, the age-old discipline of singing can benefit from the creation and evolution of this modern mind-body technique called Pilates.
Recommendations

• Development of a more advanced level of Pilates-based physical training method for singers by integrating sound and/or pitch with the sibilant [s] sound or a sustained vocalized sound for the duration of the controlled expiratory breath. Miller introduces the use of the sibilant [s] sound to further develop nonphonatory training with sound, but not pitch. ³⁰⁸

• Need for more research with well-designed studies and sound methodology testing the direct affects of Pilates-based physical training on nonphonatory training for improved voice performance.

• In order to have optimal performance potential and injury prevention in the study and practice of singing, there is a need for a better integration of new and already available mind-body techniques for voice performance training, including the Pilates-based physical training method, into the voice studio.

• More discussion needed by professional singers who are supporters of the Pilates method, including: opera singers Renee Fleming ³⁰⁹ and Denyce Graves ³¹⁰, as well as commercial pop singers like Reba McEntyre, Gloria Estefan and Madonna. ³¹¹ The discussion needs to expand into how Pilates not only supports

³⁰⁸ Miller, The Structure of Singing, 29–31
³¹⁰ Denyce Graves, Question asked by author after masterclass, University of Nevada, Las Vegas, October 25, 2007.
³¹¹ Marguerite Ogle, Report in Pilates Blog, entry posted September 20, 2007, http://pilates.about.com/b/2007/09/20/i-love-pilates-reba.htm#gB3 (accessed on November 30, 2007). Enter reads, “I love Pilates. This was Reba McEntire’s response yesterday on the Oprah show when Oprah asked her why she looked so great - hard and toned. Gloria Estefan recently told Prevention magazine that she credits Pilates with helping her get in the best shape of her life, and for helping her recover from a devastating back injury. Madonna is yet another celebrity singer known to frequent the Pilates studio.
good body posture and fitness, but how it directly impacts the vocal process as well.\textsuperscript{312}

- Since there has been no standardized testing for this type of integrated method of vocal pedagogy and Pilates-based physical training for singers, one suggested testing would be: 6 week testing of the integrated method being performed at least 4 times (day#1 and day#2 programs alternating) and coordinated with standardized vocal exercises for a controlled study to show improvement vocally by singing louder and longer without signs of fatigue.

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\textsuperscript{312} Marguerite Ogle, Report in Pilates Blog, entry posted September 20, 2007, http://pilates.about.com/b/2007/09/20/i-love-pilates-reba.htm#gB3 (accessed on November 30, 2007). Entry reads “I’m not at all surprised that these ruby-throated ladies who need to stay fit with an exercise system that is efficient and supports lean, toned bodies turn to Pilates. But I’m also thinking that the strong abs, core support, and beautiful posture that come along with Pilates training are really great for their singing as well.”; Entry posted by Louise on September 29, 2007 reads, I am studying for an MMUS in singing at Trinity College of Music, London, and take regular Pilates classes at the Laban studio. I believe strongly that learning Pilates has benefitted my singing, and am just starting a research project for my MMUS thesis on the positive effects of Pilates on singing technique.; Entry posted by Monique on October 1, 2007 reads “Pilates hits the spot, you could say. The support we need to control our breath comes from the core muscles. In addition, with good posture, a good figure and the overall body awareness and control Pilates helps you develop, a singer can feel more self-confident standing up there, baring her (or his) soul (as I always feel) in a performance. As a singer you ARE the instrument, there’s not much to hide behind, so it’s just as important to develop your body (and mind) as it is to learn the notes.”; Entry posted by Ogle on October 6, 2007 reads “This is a really interesting topic. I bet we start to hear more about Pilates and musical training.”; Associate Board of the Royal Schools of Music, VivaVox Blog, entry posted July 4, 2007, http://forums.abrsm.org/lofiversion/index.php/t24338.html (accessed November 30, 2008); Joan Melton, One Voice: Integrating Singing Technique and Theatre Voice training (Pilates Training and the Actor/Singer) (Oxford: Greenwood Publishing Group, 2008), http://www.onevoicebook.com/pilates1.htm (accessed February 1, 2009).
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