

The Efficacy of Vocal Cool-down Exercises

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INTRODUCTION

WARMING UP THE VOICE is an accepted tradition among singers and is considered essential for healthy singing technique. Centuries of experience-based practice and publications have created the belief that warm-up is a necessary aspect in voice training. Vocal cool-down at the end of a lesson, rehearsal, or performance is not yet standard practice. In recent years, singers have more frequently been encouraged to cool down the voice, but empirical and scientific data remain in their infancy with regard to evidence-based information.¹ For this to change, there is a need for more scientific research to substantiate cool-down exercises as a necessary aspect of a singer's vocal health. Until that time, it is reasonable to guide singers to cool down their voices based on current research and anecdotal experience of voice pedagogues.

WHAT IS CURRENTLY KNOWN ABOUT COOL-DOWN EXERCISES

The past few decades of research have provided more knowledge about principles of voice production. This has led to a new appreciation of the singer as a vocal athlete. Since there is historical precedence for vocal warm-ups, studies have focused on the efficacy of that aspect of training the singing voice.² One recent study of 188 music theater singers found that approximately 90% of incoming freshmen used vocal warm-ups; however, only 15% of those singers used vocal cool-downs.³ Another study of 117 participants reported that 54% always use vocal warm-ups before singing and 22% use vocal cool-downs.⁴ A recent dissertation focused solely on the efficacy of vocal cool-down exercises in nine graduate students at the Cincinnati Conservatory of Music.⁵ The results show that, based on the objective acoustic and aerodynamic measures, the impact of cool-down exercises on the voice remains unclear. The study found that there may be perceived benefits 12–14 hours after cooling down the voice, rather than immediately following. In 2012, a ground-breaking study by Verdolini Abbott et al. used secretions from the surface of the vocal folds to postulate that certain resonant voice (RV) exercises, when used after a heavy load, are more effective at helping inflammation than either voice rest

or spontaneous speech.⁶ Studies exploring the method of cool-down exercises and their effectiveness are in early stages; there is still much to be learned.

Many factors are currently known about voice fatigue that impact the understanding of cool-down efficacy. There are considerations of muscular fatigue (laryngeal and respiratory); straining of ligaments, joints, and membranes; inflammation of the vocal folds due to dehydration or chemical changes; and loss of blood circulation. It is hypothesized that there is some recovery in seconds, but other aspects of recovery may take hours or even days.⁷

The present author and her colleagues contributed to cool-down research through two studies. This article presents findings of the second study, which focused on using subjective measures to investigate singers' perceptions of changes in the condition of their voice after vocal cool-down exercises.⁸ Twenty classically trained female singers filled out three questionnaires across a two-week period (one week using cool-down and the other week

not using cool-down) requiring judgments about how their voices felt after 60-minutes of singing. Even though the objective data were statistically insignificant, the singers' subjective data clearly indicate a perceived sense of vocal well-being in both their singing *and* speaking voices after utilizing the vocal cool-down protocol.

The cool-down protocol was designed for classically trained female singers, selected based on extensive teaching and singing experience, and informed by current voice research. The cool-down protocol, as shown in Table 1, has been slightly altered in vocal range and description of some exercises from the original study for this publication. The protocol could be used for CCM singers' cool-down regimen as well, with further alterations to the vocal range and the elimination of exercises #5–7. Each exercise requires guidance from the singing teacher to establish good vocal function, just as one does during warm-ups. Teachers might consider alterations of the vocal range or order of the protocol for the individual needs of each singer.

TABLE 1. Cool-down Protocol.

Exercise	Description
1	Straw phonation a. Ascending/descending pitch glides slowly from bottom to top of a comfortable range. Repeat three times. b. Ascending/descending pitch glides phonating up the scale approximately a fifth during ascent and a third descent, continuing this pattern to the top of comfortable range before descending in the same pattern down the scale. Starting pitch approximately A ₃ . [*] This exercise is often called motorboats.
2	Hum [m] while pitch gliding scale degrees 1-3-1. Starting pitch C ₄ and ascending by half steps to C ₅ at a soft to medium soft dynamic level. Note: Humming should be sung with a relaxed jaw and tongue, and a neutral [ŋ] feeling inside the mouth.
3	Hum [m]-[i]-[m]-[e]-[m]-[a]-[m]-[ɔ]-[m]-[u] on a continuous single note, each syllable receiving a one-second duration. Starting pitch C ₅ descending to C ₄ .
4	Sing [hw]-[ɔ] on sustained pitch for a two-second duration ascending by half-steps from F ₄ to C ₅ giving particular attention to extended, gentle airflow on the [hw] syllable.
5	Gentle vocal fry for five-second durations a total of five times.
6	Sing a three-note scale using [væ] on each syllable in “chest” register ascending by half-steps from A ₃ to F ₄ (starting pitches) on a medium soft dynamic level.
7	Ascending/descending pitch glides on scale degrees 1-3-1 on [væ] in “chest” register from A ₃ to F ₄ (starting pitches). This should be sung on a medium loud dynamic.
8	Sing a five-note descending scale on soft, floaty [u] starting at C ₅ . Continue ascending by half-steps to F ₅ (starting pitch); then descending by half-steps until C ₄ is the bottom note of the five-note descending scale. This should be sung at the softest dynamic level. Note: A “floaty” [u] vowel should be sung with a great deal of ease of vocal production and forward resonance, even at a soft dynamic level. No tension should be experienced.

^{*}Tessitura alterations should be considered when necessary. It is imperative each exercise is sung with ease of function.

The cool-down protocol begins with straw phonation and humming exercises, #1–#3, categorized as semi-occluded vocal tract exercises (SOVT). The benefits of SOVT exercises, in particular straw phonation, have been largely substantiated by research.⁹ Semi-occluded exercises facilitate healthy vocal fold adduction due to the increased intraoral pressure in the vocal tract. This increased pressure helps produce healthy adduction of the vocal folds and increases vocal tract acoustic inductance, which creates efficient voicing. Humming [m] exercises #2 and #3, would be categorized as both an SOVT and resonant voice (RV) exercises. As mentioned previously, Verdolini Abbott et al. demonstrated that tissue mobilization exercises associated with RV may help to attenuate acute vocal fold inflammation more than spontaneous speech at the end of a heavy voice load.¹⁰ RV exercises are also useful in guiding the singer to feel sympathetic vibrations in the “mask” as a way to assess ideal vocal production. Exercise #4 is based on “flow phonation,” another facilitation technique frequently used in voice therapy to rehabilitate pressed phonation, where the vocal folds press tightly together, limiting airflow. Flow phonation helps to produce efficient voice production since ample airflow is used for vocal fold oscillation.¹¹ It is important to use a lengthened and gentle [hw] to connect airflow and promote efficient sound production. Although vocal fry, exercise #5, is not recommended in daily speech patterns, it is a useful facilitation technique for achieving relaxed phonation and increasing adduction in voice therapy.¹² Vocal fry must be produced without force since the sound is made when the vocal arytenoids squeeze together. This allows the vocal folds to be flaccid as air passes through, creating a popping or rattling sound. When executed within specific parameters, vocal fry can help relax the intrinsic laryngeal muscles, which is useful in the context of cool-downs. Exercises #6 and #7 are “chest” registration isolation vocal tasks. Due to the dominant use of “head” registration during classical female singing, these two vocal tasks isolate a more “chest-dominant” vocal fold configuration helping to bring the voice back to “base-line.”¹³ Concluding the cool-down protocol with the “floaty” [u], exercise #8, may reveal perceived physical changes to the singer after a heavy voice load. Ingo Titze states that if soft and high voice is difficult, especially on the day after a strenuous workout, the

singer probably has not fully recovered. The fluid and structural protein disarray and repair occur mainly in the soft tissue directly under the skin of the vocal fold. It is the integrity of this tissue that is critical for soft voice at high pitches.¹⁴ Ending the cool-down protocol with this exercise provides self-perceptual feedback about the integrity and recovery of the vocal mechanism.

SINGERS’ FEEDBACK AFTER USING A COOL-DOWN REGIMEN

The subjective research questionnaires were useful in understanding the conditions that are important to a singer’s sense of vocal well-being, particularly because of the daily changes that impact the voice. One reason it is difficult objectively to quantify the efficacy of vocal cool-downs is due to the variability in the daily life of a singer (e.g., lack of sleep, stress, menses, reflux, vocal load, and vocal hygiene). The feedback from singers clearly identified challenges of voice self-assessment because of these factors. Sleep is certainly an issue for singers in both its emotional and physical impact on the voice. Singers frequently mention menses, allergies, dehydration (sometimes due to alcohol), stress, sickness, reflux, and extended choir or opera rehearsals. Each circumstance was mentioned numerous times by research participants. Singers’ feedback confirms that physical and emotional health has a profound impact on their daily vocal self-assessments.

The questionnaires collectively revealed singers’ overwhelmingly favorable responses to the use of cool-down exercises on their singing and speaking voices. The majority remarked on the positive impact on their overall sense of vocal well-being as a result of including the cool-down exercises in their vocal regimen. Straw phonation and humming were perceived as the most successful at reducing vocal fatigue. Humming exercises were perceived to “refocus” their speaking voice, which strongly impacted the singer’s sense of recovery from vocal fatigue. The impact on the speaking voice was among the many benefits of incorporating a cool-down protocol at the end of a heavy singing load. Female classical singers, particularly voices that spend extended periods of time in a high tessitura, often sense a “fuzzy” speaking voice after a rehearsal or performance. They self-report significant improvement of this issue following the cool-down protocol. When the speaking voice

more quickly returns to “base line,” a stronger sense of vocal well-being and peace of mind is achieved.

The floaty [u] was also among the preferred exercises. Sometimes an [u] vowel, especially through the *passaggio* or sung softly in a higher tessitura, can create tension due to laryngeal elevation for a singer unfamiliar with this exercise. Therefore, the singer must be carefully guided to functionally sing this vocal task to condition a balanced voice, helping with voice fatigue, and assessing voice recovery after a great deal of singing.

The “chest” registration exercises assisted a majority of singers in transitioning back to their speaking voices, although participants unfamiliar with singing in that register expressed concern with the impact on the voice.

Responses to the vocal fry exercise were the most diverse. Singers made both positive and negative remarks about it; however, the majority of the singers stated that vocal fry resulted in a more relaxed speaking voice. Even when vocal fry was hard to achieve after extensive singing, they felt it significantly improved the voice returning to “normal.”

In general, singers were quite passionate in their perceived sense of vocal well-being as a result of employing the vocal cool-down protocol. The study unexpectedly coincided with the start of a university opera production that involved many of the singers in the study. In addition to academic studies, regular lessons, and choir rehearsals, many were participating in a four-hour opera rehearsals at night and all day on most weekends. Singers frequently stated that they experienced faster recovery from vocal fatigue, and felt less vocal fatigue in general, because of the cool-down protocol. Many observations were made about the cumulative impact; they felt able to sing longer before experiencing vocal fatigue during the week they utilized cool-down exercises as compared with the week they did not. Singers also stated that it was easier to warm the voice back up on the days they had to return to singing attributing this to the cool-down exercises. The majority of singers reported the likelihood of using cool-down exercises in the future, especially on days that included a great deal of singing. Even if they did not use the entire protocol, they would choose exercises perceived to have the most positive outcome, and might potentially change the order of the cool-down protocol to fit their individual needs.

DISCUSSION ABOUT THE STUDY AND COOL-DOWN EXERCISES

The variability in the daily life of a singer (e.g., stress, menses, reflux, lack of sleep, voice load, illness, allergies, and vocal hygiene) makes it difficult to quantify the impact of vocal cool-downs. Singers would need to live in a bubble for the duration of a study to maintain complete accuracy. Yet variability is what renders the study valid, interesting, and viable in representing the life of a singer. Vocal athletes have many factors to consider in order to maintain their vocal health.

Subjectively, singers in this study strongly perceived a positive impact from the cool-down exercises. Although research of cool-down exercises is still in its infancy, there is evidence to indicate the necessity to include a cool-down regimen after a heavy singing (or speaking) voice load. For singers, psychological components are important in an overall sense of vocal well-being. If cooling down the voice contributes to feeling vocally healthier, it should be strongly considered, since much of a singer’s success is self-perception.

Educating singers to include a cool-down protocol (just as one does for warm-ups) is absolutely necessary. For singers to feel vocally comfortable with an exercise, they must be trained to sing it functionally because the benefit is only achieved (and possibly perceived) if the exercise is properly executed. Singers must understand the intent of each exercise and its impact on vocal function for long-term success. Singers not accustomed to the concept of cross-training need particular guidance in certain exercises. For example, a singer with a weaker “head” register may find the “floaty” [u] exercise challenging. Alternatively, a singer unfamiliar with isolating “chest” register and not properly trained in exercises such as the low tessitura [vae] may experience difficulty. Depending on a singer’s individual needs, consideration should be given to the vocal range of each exercise, order of the protocol, and overall length of time spent. Cool-down exercises, just like warm-ups, can be successful only with proper guidance and training.

CONCLUSION

Singers are taught the importance of warming up the voice from the beginning of vocal studies. They become a crucial part of a classical singer’s training and routine.

This study indicates that also including a cool-down regimen after a heavy voice load is equally important. Perceptually, vocal cool-downs lead to faster recovery time, return the speaking voice to normal more quickly, and create a significantly improved overall sense of vocal well-being after significant length of singing.

Whether the perceived benefit is psychological or physiological in nature is yet to be conclusively determined. It is clear that singers are highly attuned to subtle changes in their own voices. It is anticipated that further scientific research will confirm the benefits of cool-down exercises through biomechanical, acoustic, aerodynamic, and psychological measures. In the meantime, it is strongly recommended that vocal athletes implement cool-down exercises as part of their singing regimens in order to support optimal vocal health.

Further information can be found at KariRagan.com, including a YouTube link demonstrating the cool-down protocol; a cool-down protocol handout; the original *Journal of Voice* article and a YouTube link from the 2015 Voice Symposium paper presentation.

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