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ORIGINAL ARTICLE

The Effects of Musculoskeletal Training and Stretching on the Duration of Vocalization Time

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ABSTRACT

Background. Musculoskeletal training and stretching aim to maximize vocalists' physical capacity. **Objectives.** This study aimed to determine the effects of core training and stretching, on the physical capacity of vocalists. **Methods.** The participants included 14 vocalists, divided into the core training group and the control group. The training was performed for 75 minutes per session for 8 weeks. The maximum phonation time was measured before and after the experiment to prove the effectiveness of this study. **Results.** The exercise and stretching programs led to significant improvements in the physical factors associated with the increase in maximum phonation time. **Conclusion.** Training programs targeting specific areas that require improvement will increase singing ability.

KEYWORDS: ***Musculoskeletal Training, Stretching, Vocalization Time.***

INTRODUCTION

Vocalization is the process of generating a voice, and the desired duration, size, and speed of vocalization are important (1). Vocalization is the voice that comes out while the air from the lungs is exhaled out of the mouth. It is thought that the development of the musculoskeletal system will be helpful. In particular, direct respiratory muscles and indirect respiratory muscles are directly related to vocalization. Direct muscles include the diaphragm and the muscles attached to the ribs, and the indirect muscles can be defined anatomically as those with only one part of the muscle attached to the ribs. Both types of muscles are involved in vocalization, so body alignment and muscle condition are important for vocalization (2).

Musculoskeletal training is a type of integration exercise that allows the use of the entire body where the core is maintained and muscle and articular stability are developed considering the safety of each joint. It has thus been reported to prepare a person for specific skills (3, 4). For training to enhance athletic performance, the principle of Specific Adaptation to Imposed Demands should be applied (5, 6), which leads to the formation of functional movement patterns. Athletes must achieve an enhanced quality of exercise rather than increased exercise (7). Investigating the above research, there is no research on vocalists precisely, however since training is effective for athletes, it is thought that it will be useful for vocalists. The purpose of this research is to study the effect of stretching and core exercise on the duration of vocalization.

MATERIALS AND METHODS

Participants. This study included 14 female vocalists with career lengths of 10 or more years,

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in South Korea. In this study, 7 participants in the experimental group and 7 people in the control group were randomly divided. All research participants participated voluntarily in carrying out this research project. No participant had any physical limitations throughout the study period, as individuals with limitations such as any neck pathological problem within the previous 6 months were excluded. Before conducting the study, the purpose and procedures were explained to all participants, from whom consent to participate was obtained. The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the institution's human research committee.

Procedures. In this study, the exercise application was set slightly differently according to the step, and stretching was included at the beginning and end of every exercise. For the first 2 weeks, this study tried basic exercises without any tools, and from the third week, we focused on increasing the concentration of training using tools such as bosu and gym balls (Table 1). After 8 weeks of exercise in the experimental group, this study plans to ask them about their subjective opinions about body changes and vocalizations. Also, stature and weight were measured again after 8 weeks.

Measurement. The Exercise with counting seconds like a plank was measured using a stopwatch (Stop Watch, Pro-Specs, China) while the participant was prone on the floor. The exercise to measure the posture and the number of movements was performed under the guidance of 3 professional trainers with more than 10 years of experience after graduating from university. In this study, the maximum phonation time (MPT) was measured before and after the experiment to prove the effectiveness of this study. The MPT was measured before the start of the experiment, after 2 weeks, after 5 weeks, and after 8 weeks, respectively. The MPT was measured All data were analyzed using SPSS version 21.0. The pre-test and post-test measurements of participants of this study were analyzed using a paired t-test. The statistical results were analyzed using an independent t-test. The level of significance was set to $P<0.05$.

RESULTS

After exercise for 8 weeks, the average weight of the experimental group decreased by 1.2 kg, and the height increased by 0.9 cm. On the other hand, in the control group, the weight was increased by 0.1 kg and the height was decreased by 0.2 cm (Table 2).

In the experimental group, the average MPT was 16.5 seconds before the exercise, 16.7 seconds after 2 weeks of exercise, 17.5 seconds after 5 weeks of exercise, and increased to 19.3 seconds after 8 weeks of exercise. However, in the control group, the average MPT was 17.3 seconds before the exercise, 16.9 seconds after 2 weeks of exercise, 17.7 seconds after 5 weeks of exercise, and did not increase significantly after 8 weeks of training. The average age of the participants in this study was 34 years old in the experimental group and 33 years old in the control group, and there was only one year older (Table 2).

Table 1. Training Program for the Experimental Group

Program / Content	Intensity	Time
Warm-up		
Breathing, Spinal rotation		**5min**
Upper and lower stretching		**10min**
Core exercise (1-2 weeks)	**rep 15 3 times**	**50min**
Bridge		
Toe touch		
Crunch		
Bird dog		
Leg raise		
Superman		
Plank (30 seconds)		
Side plank		
Squat		
Core exercise (3-5 weeks)	**rep 15 3 times**	**50min**
Crunch		
Crisscross		
Dead bug		
Plank with bosu		
Side plank with bosu		
Back extension		
Lunge		
Deadlift		
Core exercise (6-8 weeks)	**rep 15 3 times**	**50min**
Crunch with the gym ball		
Leg curl with the gym ball		
Squat with bosu		
Lunge with bosu		
Front squat		
One-leg deadlift		
Cool down		
Static stretching		10min

DISCUSSION

The various exercise methods for improving performance in the sports field have been studied,

however, it is difficult to find research on exercise training for vocal music. In this study, vocalization was also a result of muscle contraction, and it was thought that the condition of the muscle would affect the vocalization.

Physical training with stretching allows athletes to achieve a higher level of performance and endure repeated training (8). Liu et al. reported an improvement in muscular strength after training (9), and Proto reported a significant correlation between muscular strength and grip strength (10). Strong grip or muscle strength while singing is thought to help sing.

Table 2. Basic Information and Results of this Study

	Experimental group	Control group	t	p
Age (years)	Average 34 (25-39)	Average 33 (26-40)		
Stature (cm)	162.2 ± 4.4	163.3 ± 3.6		
Weight (kg)	58.3 ± 3.5	55.8 ± 5.6		
MPT (second)	16.5 ± 4.7	17.3 ± 4.1		
MPT after 2 weeks	16.7 ± 5.6	16.9 ± 5.9		
MPT after 5 weeks	17.5 ± 6.4	17.7 ± 4.7		
MPT after 8 weeks	19.3 ± 6.6	17.9 ± 6.6	1.407	0.144
Stature (cm) after 8 weeks	163.1 ± 4.1	163.1 ± 3.8		
Weight (kg) after 8 weeks	57.1 ± 3.6	55.9 ± 5.7		

T: Independent t-test, Values: Mean ± Standard deviation, P<0.01

Strengthening the core abdominal muscles and the trunk, the muscles responsible for maintaining spinal stabilization could improve trunk muscular strength and agility, while balance and overall muscular strength could be enhanced via the routes of force across the upper and lower bodies based on the lumbar areas and the center of the trunk (11). Specifically, the plank and side plank is a very common exercise for core stabilization that increases trunk muscle activity (12, 13). It is presumed that the efforts to maintain a diversity of postural patterns against weight during each training program caused changes in performance by increasing trunk stability. Not only plank but also crunch, dead bug, and deadlift strength exercises, so training in this study focused on the trunk was positive feedback to vocalization.

Bridge, Crunch, and dead bug were performed for 15 repetitions 3 times to strengthen the abdominal capacity and the experimental group showed a significant improvement. All of the above exercise methods are applied to many exercise training to strengthen the abdominal muscles in the trunk (14-16). A study related to voice was conducted on patients with central nervous system disorder (17), and it would be good to further study whether core exercise affects vocalization in these patients. There is abdominal breathing in vocal music, and this study thinks that strengthening the abdominal muscles will be a good condition to produce better outcomes when singing.

The exercise programs applied in this study increased the stature of the participants by 0.9 cm (Table 2). Most of the exercises are applied to strengthen the core muscles, but some exercises such as a plank strengthen the erector spinal muscle and increase the stature. When the participants of this study were asked their personal opinions after 8 weeks of exercise, most answered that the body seemed to be more aligned and that breathing seemed to have a positive effect on good vocalization.

CONCLUSION

The measured variables showed that exercise and stretching programs led to significant improvements in the physical factors associated with the increase in vocalization of vocalists.

APPLICABLE REMARKS

- Providing training programs suitable for specific areas requiring improvement will positively affect vocalists.

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AUTHORS' CONTRIBUTIONS

Study concept and design: Jehun Lee. Acquisition of data: All. Analysis and interpretation of data: All. Drafting the manuscript: Kwon & Lee. Critical revision of the manuscript for important intellectual content: Misun Lee. Statistical analysis: Misun Lee.

Administrative, technical, and material support: All. Study supervision: All.

CONFLICT OF INTEREST

The authors mention that there is no “Conflict of Interest” in this study.

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