Avoiding Discomfort and Injury in Young String Players:

A Stretching Activity Guide

by Joshua Russell and Paul Higgins

String educators are becoming increasingly aware of the health and wellness issues facing young string players. The demanding and repetitive nature of the physical actions undertaken by young string players can cause physical discomfort, which may lead to injury or attrition. Researchers have found that string players encounter music-induced pain as early as high school students or younger (Brandfonbrener, 2009). Based on the growing evidence that younger musicians can experience musculoskeletal pain, it behooves string teachers to find strategies to mitigate the discomfort of their students in order to foster a life-long participation in music as well as avoid possible injury.

Researchers (e.g., Rardin, 2007; Russell, 2006) have examined a number of possible ways to help students avoid physical discomfort including warm-ups, physical exercise, and stretches. Rardin (2007), for instance, found that students who participated in an injury prevention program that included physical warm-ups, reported less pain than they did before the injury prevention program. Given such findings, it appears that string educators can take steps in helping their students experience less physical discomfort while playing their string instruments. In the following pages, we will discuss the loci of the physical discomfort reported by elementary, middle school, and high school aged string students, as well as a series of physical warm-ups and stretches without the instruments that could be implemented in a string orchestra classroom or in a private studio.

In a recent survey of 357 school-aged string players (elementary = 101, middle school = 97, high school = 159), young string players indicated where and to what extent they felt physical discomfort when playing their instrument. Although the participants indicated experiencing minimal discomfort (largest mean was 1.87 on a scale of 1 = no discomfort to 5 = great discomfort), the participants did indicate experiencing the most discomfort in the shoulders, neck, left hand, and back. Participants indicated the least discomfort in their elbows, forearms, and right hands (see Table 1).

Based on these findings and using data reduction techniques, we were able to categorize the reported physical discomfort into five major areas of the body—the back (consists of all of the items pertaining to upper, middle, and lower back), the forearm (includes both forearms, as well as the right wrist), the shoulders (includes each side of the shoulders and neck, the hands (consists of all the pain experienced in the hands and fingers, and the elbows (comprised of both elbows).

Given the nonexistent discomfort reported by participants in the elbows, we will focus our stretches and warm-ups on the four areas that may be most beneficial to the largest number of students and teachers.

Table 1

Reported Musculoskeletal Discomfort Loci (1= no discomfort, 5 = great discomfort)

Body Area	Mean
Left shoulder	1.87
Right shoulder	1.83
Left side of the neck	1.80
Left fingers	1.79
Right side of the neck	1.65
Left upper back	1.61
Left hand	1.59
Left lower back	1.58
Right upper back	1.58
Right lower back	1.58
Right middle back	1.58
Right hand	1.53
Right forearm	1.53
Left wrist	1.52
Lower middle back	1.51
Right wrist	1.50
Right fingers	1.46
Left forearm	1.43
Right elbow	1.27
Left elbow	1.26

Stretching Guidelines for Young String Players

Stretching Intensity
One challenge with a stretching program is choosing the best descriptors for how intense a stretch activity should be to achieve optimum results. Woods et al (2007) claimed that healthy examples of verbal instructions on stretching include "tightness without pain," "gentle stretch," "pulling sensation," and "noticeable tension without pain." We will add to this list of common phrases and recommend a "low load across the muscle, held for a long duration." Regardless if the stretch goal is to prevent injury or treat an existing injury, the stretch activity should never be painful for a student.

Stretching Length
The length of time a stretch activity should be held is the second characteristic of a stretching program that should be discussed. The stretching program will be a static activity, further defined as applying a low load across the muscle tissue that is held for roughly 30 to 60 seconds (Feland et al, 2001; Woods et al 2007). Holding a low load for a minimum of 20 seconds allows for connective tissue to elongate (Woods et al, 2007). The elongation of connective tissue is important to a string player as it allows for full range of motion and optimal function during instrument play. Woods and colleagues (2007) also suggested that muscle length will increase with three repetitions, held for duration of 30 seconds and maintain the greater part of this increase during the first 15 minutes of physical activity. This means that string players will enjoy greater coverage across their instrument, improved mobility, and more fluid playing techniques, when they take the time to stretch in a healthy and meaningful manner.

Stretching Schedule
Taking into account the growing evidence of string players' physical discomfort, we believe that string educators in classrooms and in studios can help their students by teaching them a stretching program as a means of prevention of musculoskeletal injury or treatment of minor muscle pain. In order to receive the greatest benefits, the stretching program outlined below should be performed:

- Within 15 minutes prior to playing one's instrument
- With an intensity that is a low load across the tissue, without pain
- For a duration of 30 to 60 seconds
- Three times for each individual stretching activity
- While continuing to breathe throughout each stretching activity

It is also highly beneficial if the students maintain proper posture while stretching. Generally speaking, good posture while stretching includes:

- Head up, ears in line with shoulders
- Shoulders in a mid-line position, slightly back, yet relaxed
- Low back upright, pelvis slightly tilted back
- Knees bent, feet flat on the floor
- Breathing through the abdomen not the chest

We would like to point out that at no point should students experience pain. They should be guided through the ability to discern pain from stretching or fatigue, but if pain is experienced, the student should stop the stretching activity immediately and consult a physical therapist or healthcare professional.

Stretches for the Back

We encourage teachers to show their students three specific types of stretches designed to help students alleviate discomfort in their backs. Although it may seem that these stretches focus on the legs, it is important for young people (string player or not) to realize that the relationship between the back and the legs is an important one. The muscles of the spine are required to support your trunk through various positions while playing your instrument. The muscles of the spine rely on the pelvis for a pivot point during movement. This pivot point (the pelvis) has a direct influence on your posture and positioning. Rolling your pelvis forward (anterior), increases the curve in your low back (increasing lordosis) while rolling the pelvis back (posterior) decreases this curve.

The muscles of the lower extremity also use the pelvis as a pivot point. The muscles of the thigh have attachment points along the pelvis and can effect pelvic position as well. A stretching program that includes the lower extremity (muscle of the back of the thigh specifically), and gluteal region will allow for a relaxation of the muscles of the lumbar spine by decreasing the amount of pull from the spinal muscles and from the lower extremity muscles as well.

Single Knee to Chest Stretch
The first stretch for the back is the single knee to the chest stretch. The purpose of this stretch is to elongate the lower spinal muscles, gluteal and thigh muscles (back of the thigh). This stretch, when done properly promotes a posterior pelvic tilt, decreasing the forward curvature of the spine (lordosis).

- Lie on your back with both knees bent, feet flat on the floor
- Reach behind one knee and pull toward your chest
- Relax the spine and abdomen during the stretch, remember to breathe
- Hold stretch position 30 to 60 seconds
- Repeat three times with each leg

Hip Rotation Stretching

The second stretch that we recommend for the back is the hip rotation stretch. This stretch will help students (and you) to elongate the hip rotators, including the gluteal muscles. The muscles of this region have a direct attachment from the pelvis to the long bone of the thigh.

A

B

A) Beginner

- Lie on your back with both knees bent, feet flat on the floor
- Place your right foot on your left knee (cross leg position)
- With your right hand, push your right knee away from you
- Relax the spine and abdomen during the stretch, remember to breathe
- Hold stretch position 30 to 60 seconds
- Repeat three times with each leg

B) Advanced

- Lie on your back with both knees bent, feet flat on the floor
- Place your right foot on your left knee (cross leg position)
- Reach behind your left thigh with both hands and gently pull the thigh toward your chest
- Relax the spine and abdomen during the stretch, remember to breathe
- Hold stretch position 30 to 60 seconds
- Repeat three times with each leg

Hamstring Stretching

The final stretch for the back is the hamstring stretch. This stretch will elongate the muscles of the posterior thigh and gluteal region. Stretching will decrease the pull of the hamstring muscles, resulting in less pull on the pelvis at the attachment site.

- Lie on your back with both knees bent, feet flat on the floor
- Reach behind one knee, straighten the knee, and pull the leg toward your chest
- Relax the spine and abdomen during the stretch, remember to breathe
- Hold stretch position 30 to 60 seconds
- Repeat three times with each leg

Stretches for the Forearms

In order to prepare the forearms for healthy playing, we will describe two different stretches; one that focuses on wrist flexor muscles and another that focused on wrist extensor muscles. The large muscle groups in our forearms are primarily responsible for controlling our wrists and fingers. Flexor muscles are any muscles that decrease the angle of a joint while extensor muscles enlarge an angle. In our forearms, our flexor muscles are found on the anterior forearm (the side pointed in front of us when we give a high five) while the extensor muscles are found on the posterior forearm (the side pointed behind us when we give a high five). These muscles (among other things) control the position of our wrists and finger motions. As both the flexor and extensor muscles are imperative for healthy and pain-free string playing, and we suggest stretching both sides equally.

Wrist Flexor Stretching

This first stretching activity is intended to help relax the flexor muscles found in the anterior forearm and hand.

- In a standing or seated position extend your left arm forward
- Raise the hand upward, fingers pointing up
- With your right hand apply pressure against the palm of the left hand
- Pulling the hand and fingers toward you, remember to breathe
- Hold the stretch for 30 to 60 seconds
- Repeat three times with each arm

Wrist Extensor Stretching

This exercise will help stretch and prepare the extensor muscles found in the posterior forearm and hand.

- In a standing or seated position extend your left arm forward
- Let the left wrist fall downward
- With your right hand apply pressure against the back of the left hand
- Pulling the hand and fingers toward you, remember to breathe

- Hold the stretch for 30 to 60 seconds
- Repeat three times with each arm

Stretches for the Shoulders and Neck

We carry a great deal of our tension in our shoulders and neck. Even young students feel tension in these areas, often without knowing it. Add to this tension, the act of playing a string instrument (especially a violin or viola) and the likelihood of discomfort is high. To help mitigate these issues, we suggest four different stretches. Three can be done in a standing position at the students' chair in the classroom, one requires the use of a doorway and might be more pragmatically possible for a private studio instructor.

Neck Stretch One

In this first neck stretch, we start at the top of the body (the head). We will work our way down as we move to the different stretches for the neck.

- In a standing position, with one hand reach to the top of your head
- Gently, pull the head towards your shoulder
- Hold the stretch for 30 to 60 seconds, remember to breathe
- Repeat three times with each side

Neck Stretch Two

A

B

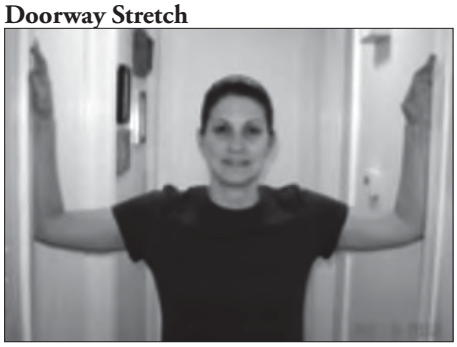
A) Beginner
- In a standing position, with your left hand reach across your body and grab your right elbow
- While pulling the elbow across your body, tilt your head to the left
- Hold the stretch for 30 to 60 seconds, remember to breathe
- Repeat three times with each side

B) Advanced
- In a standing position, reach your right hand to the back of your head and your right hand behind your back
- Gently pull the head downward toward the front of the shoulder.

Neck and Shoulder Stretching

If your classroom or studio space (or number of students) will allow, you can also teach students to stretch the muscles in their necks and shoulders at the same time using an open doorway (or maybe even the space between two large instrument cabinets).

Doorway Stretch



- Standing in a doorway, reach both hands to the door frame, approximately the height of your head
- From that position, a short step forward will produce a gentle stretch
- Keep the chin up and remember to breathe
- Hold the stretch for 30 to 60 seconds
- Repeat three times

Shoulder Stretch

The doorway stretch focuses the muscles of the chest and front of the shoulder; this next stretch focuses on the upper portion of the back and back of the shoulder.

- In a standing position, place your right hand on your left shoulder
- Using your left hand, grab your right elbow and gently pull your arm across your body
- Hold the stretch for 30 to 60 seconds, remember to breathe
- Repeat three times with each arm

Stretches for the Hands

String players ask their hands to do wonderful things; wonderful, complex, and possibly unhealthy things. Although evolution has designed the hand primarily for holding rough tools, string players, among many other musicians and professionals from infinite fields outside of music, force their hands to go well beyond holding an ax or adz. In doing so, we increase the

possibility of acute physical injury. To help mitigate these possible injuries, we suggest the following stretching routine.

Hand Stretching

- In a standing or sitting position, make a fist then extend the fingers and hold
- Make a fist, extend and separate the fingers
- Make a fist, extend the fingers and thumb, with opposite hand gently pull the thumb away from the palm of the hand
- Holding positions for 30 to 60 seconds repeat three times

Final Thoughts

Music educators are taking on increasingly more roles in classrooms. We not only teach musical topics such as string techniques, musicianship, history, theory, creativity, and literacy, we also teach (either overtly or by example) nonmusical lessons (i.e., character, reading, etc). It becomes increasingly clear, however, that string teachers need to take on one more role: physical educator. The physical health of our students is one way that our technical teaching will allow us to fulfill an oft-cited philosophical foundation of music education: lifelong participation. The healthier our students are and the better they know how to keep themselves healthy once they have moved on from us, the more likely they will be able to play healthily and happily throughout their lives. Teaching our students how to stretch the muscles most associated with string playing may be a major step in that direction.

References

Brandfonbrener, A. G. (2009). History of playing-related pain in 330 university freshman students. *Medical Problems of Performing Artists, 24*(1), 30-36.

Feland, J. B., Myrer, J. W., Schulthies, S. S., Fellingham, G. W., & Meason, G. W. (2001). The effect of duration of stretching of the hamstring muscle group for increasing range of motion in people aged 65 years or older. *Physical Therapy*, *81*(5). 1110-1117.

Rardin, M. A. (2007). *The effects of an injury prevention intervention on playing-related pain, tension, and attitudes in the high school orchestra classroom.* (Unpublished doctoral dissertation). University of Southern California, Los Angeles.

Russell, J. A. (2006). The influence of warm-ups and other factors on the perceived physical discomfort of middle school string students. *Contributions to Music Education, 33*(2), 89-109.

Woods, K., Bishop, P., & Jones, E. (2007). Warm up and stretching in the prevention of musculoskeletal injuries. *Sports Medicine*, *37*(12). 1089-1099.

Endnotes

[1] We would like to thank Jennifer Higgins, PT, for demonstrating the stretches for this article.

Joshua A. Russell

Joshua A. Russell is assistant professor of music education at the Hartt School of the University of Hartford where he teaches undergraduate and graduate courses in music education and directs the Hartt String Project. Russell received his Ph.D. from the University of Colorado, Boulder and his M.M. degree from Northwestern University. Russell currently serves on the editorial boards of the *Journal of Research in Music Education* and the *String Research Journal*. He has contributed to a number of journals including the *Journal of Research in Music Education*, *Arts Education Policy Review*, *American String Teacher*, the *String Research Journal*, *Music Education Research*, and the *Music Educators Journal*.

Paul Higgins

Paul Higgins is an assistant professor in the department of Rehabilitation Sciences at the University of Hartford. He earned his master of physical therapy from American International College in 1999 and transitional-DPT from Simmons College in 2006. He began teaching at the University of Hartford as an adjunct professor in 2003, hired full time in 2009, and is currently teaching physical agents, anatomy and orthopedic pathology. Clinically he is working in orthopedics and sports medicine, and is co-owner of University Physical Therapy, LLC in West Hartford, Conn. His research interests include physical agents and athletic performance.