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)

<table>
<thead>
<tr>
<th>Body Area</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left shoulder</td>
<td>1.87</td>
</tr>
<tr>
<td>Right shoulder</td>
<td>1.83</td>
</tr>
<tr>
<td>Left side of the neck</td>
<td>1.80</td>
</tr>
<tr>
<td>Left fingers</td>
<td>1.79</td>
</tr>
<tr>
<td>Right side of the neck</td>
<td>1.65</td>
</tr>
<tr>
<td>Left upper back</td>
<td>1.61</td>
</tr>
<tr>
<td>Left hand</td>
<td>1.59</td>
</tr>
<tr>
<td>Left lower back</td>
<td>1.58</td>
</tr>
<tr>
<td>Right upper back</td>
<td>1.58</td>
</tr>
<tr>
<td>Right lower back</td>
<td>1.58</td>
</tr>
<tr>
<td>Right middle back</td>
<td>1.58</td>
</tr>
<tr>
<td>Right hand</td>
<td>1.53</td>
</tr>
<tr>
<td>Right forearm</td>
<td>1.53</td>
</tr>
<tr>
<td>Left forearm</td>
<td>1.52</td>
</tr>
<tr>
<td>Lower wrist</td>
<td>1.51</td>
</tr>
<tr>
<td>Right wrist</td>
<td>1.50</td>
</tr>
<tr>
<td>Right fingers</td>
<td>1.46</td>
</tr>
<tr>
<td>Left forearm</td>
<td>1.43</td>
</tr>
<tr>
<td>Right elbow</td>
<td>1.27</td>
</tr>
<tr>
<td>Left elbow</td>
<td>1.26</td>
</tr>
</tbody>
</table>
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) 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)
• 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

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.

• 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 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.

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

Stretches for the Forearms

• 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.

**Neck Stretch Two**

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.

**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.

A) Beginner

• 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

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

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