The Archer's Guide to Viola Playing

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THE ARCHER’S GUIDE TO VIOLA PLAYING

By

Lauren Emily Miller

A DOCTORAL ESSAY

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements for
the degree of Doctor of Musical Arts

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THE ARCHER’S GUIDE TO VIOLA PLAYING

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Performance related musculoskeletal disorders are common in musicians. Studies show relatively high numbers of these disorders among violinists and violists. These disorders can occur because violin and viola players often do not make movement, coordination, injury prevention, and tension redistribution their foundational priority. String players often allow the visual and auditory aspects of practice and performance to become their top priority. Musicians are constantly in motion, but they rarely describe what they do using movement vocabulary or as a movement sport. Unfortunately, movement vocabulary is typically reserved solely for enhancing stage presence, reducing pain or repairing an injury.

Archery is a sport that utilizes a very similar set-up, similar movements and many of the same muscle groups that viola players use. Like music, archery is also an art form that requires discipline and patience. Archery pedagogy emphasizes the importance of creating a shooting objective and the promotion of physical knowledge and wellness before even picking up the bow. Aiming for the target is the final step in the draw process because the shot is done with the body and the vast majority of the shooting process is physical.
This essay synthesizes and applies the fundamentals of archery technique, pedagogy and training to viola performance by prioritizing the physical aspects of playing and promoting the use of proper back tension.
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Chapter 1

Introduction

Statement of the Problem

In the twenty-first century, children are taught from an early age that humans possess five senses: sight, sound, touch, taste, and smell. Human beings also possess a natural kinesthetic sense or sense of how they move. Unfortunately, many individuals learn to suppress their kinesthetic sense throughout their lives. Musicians and non-musicians alike are conditioned to sit, stand, and move in ways that fight their natural design. The result is tension, chronic pain, and injury.  

Musicians work very hard to train their auditory and visual senses and for good reason. Musicians has a lot to think about when practicing and performing, including playing the correct notes, stage presence, producing a good tone, phrasing, bowings, dynamics and other accidentals written on the page. However, musicians commonly allow the visual and auditory aspects of practice and performance to become their top priority.

Although attention to the auditory and visual may seem reasonable, since a musician’s audience enjoys their craft with their eyes and ears, musicians move their bodies for a living. Violists rarely describe what they do using movement vocabulary because movement is almost always put last on their list of priorities. Movement vocabulary is instead solely reserved for talking about stage presence.

2 Ibid, 14
3 Ibid, 13
4 Ibid, 10.
or repairing an injury. The physical aspects of performance, set-up, and revisions only take priority during the first one to two years of playing. A lack of continued focus on the physical aspects can ultimately lead to the downfall of a musician’s physical comfort and even his or her career.

Performance related musculoskeletal disorders are common in musicians. Studies show numbers ranging from between 73.4% to 87.7% in instrumental musicians. Unfortunately, data also shows that musculoskeletal disorders are most commonly developed in string players. String players often utilize a backwards approach to movement, coordination, injury prevention, and tension redistribution rather than making it the foundational priority. Many violists, focus so intently on mastering notes, rhythms, and developing their aural skills that they completely ignore the coordination and tension redistribution until an injury occurs. Some of this negligence comes from the need to quickly build up repertoire, but many physical problems stem from the long-term suppression of the kinesthetic sense long after a violist learns the basics of viola playing.

From a personal perspective, I experienced first-hand the severe problems that can emerge when the kinesthetic sense becomes suppressed. During my early years as a violist, I endured a constant struggle with pain and injury. I was told “the bigger the viola, the bigger the sound.” That was the extent of the instruction

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5 Johnson, 10.
8 Ibid.
9 Johnson, 13.
10 Ibid.
I received on sound production as a violist. My teachers told me that I should not use my small stature as an excuse for any technical setbacks.

The viola does not come in standard sizes, as do the violin and the cello. There is no such thing as a full-size viola. Instead, violas are measured in inches.\textsuperscript{11} Violas come in sizes from 15 inches to 18 inches. When it comes to choosing a viola, both the un-orthodox sizes and the non-standard proportions must be taken into consideration.

I began playing the viola when I was 12 years old just as I was leaving middle school. The music classes in school were sometimes as large as 50 students and met for roughly an hour twice a week. The school’s main objective was to ensure that the students learn to play the notes on the page with the sole intention of performing them. Once a student could start playing the notes, then technique, coordination, and natural movement were ultimately ignored. This type of learning continued throughout my middle school and high school years.

Consequently, my level of playing plateaued. My musicality and technique were improving, but I was not improving as a violist. I am just under five feet tall. I have short arms, small hands and a short pinkie, yet I was playing a 16.5-inch viola, which is size commonly played by violists of all abilities.\textsuperscript{12} My early instructors insisted that I find a way to make the large instrument work for me. After all, I was led to believe that playing a viola that was too large for me was the best means of producing a full and resonant sound. Sounding good was extremely important to my instructors and to me, but what about feeling well

\textsuperscript{12} Ibid.
physically? The result was often constant pain in my left hand, pain in my bow arm, pain in my shoulders and back, and a noticeably awkward bow hand.

I never wanted to practice, not because I was bored, but because I was frustrated and in pain. I began to avoid practicing, because I believed that there was no point. Every time I picked up the viola my whole body ached, and it didn’t matter how much I practiced; nothing ever improved. I started asking myself “What’s the point? Why bother trying? I’m clearly not good at this.”

I recognized that I needed some help. That help came in the form of Dr. Jerzy Kosmala, Professor Emeritus at Louisiana State University and current Professor of Viola at the University of California at Irvine. Watching Dr. Kosmala play changed my entire outlook on playing the viola. He did not struggle; it was not work; but rather, his playing was relaxed and flowed naturally. His sound was full and resonant, yet his playing looked effortless. I instantly knew this was how I wanted to play, although it was only after many years of training with Dr. Kosmala and other pedagogues that I began to understand what had gone wrong in my earlier years.

I have since learned that my frustrations as a young violist were not unique to me. The principal violist of the New York Philharmonic, Cynthia Phelps, struggled with many of the same issues, including poor technique and a weak sound. Through her experience over the years with various viola pedagogues, including William Primrose and Donald McInnis, Ms. Phelps learned

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the “marriage of technique and art.” The changes she adopted from these viola pedagogues influenced her bow arm, her posture and her stance, and the changes helped insure her strong sound and healthy playing technique.

According to violist and pedagogue Jodi Levitz, Professor of Viola at the Frost School of Music, there are quite a few risk factors that can lead to pain and injury among viola players.

“In my experience, shoulder and arm pain comes up the most when violinists and violists have complaints. In my opinion, the principal causes of these issues are the following: improper technique, poor posture, unsuitable ill-fitting shoulder pads and/or chin rests, playing without proper warm up and practice technique that pushes the body too far and leads to injury. Back pain, especially lower back, tends to come up when folks play sitting in orchestra and/or chamber music with poor posture and/or poor chairs.”

While studying with Dr. Kosmala, I also learned more about different violas and the customized styles that were available. I learned that a common trend among violists of small stature is to buy instruments in which the luthiers take a large instrument body and put it on a shorter and sometimes thinner neck to maximize both sound and comfort. The shorter, thinner neck, in particular, began an important feature for me.

Throughout my life, I have been heavily involved in fitness activities, wellness and sports. Each sport required a healthy balance of strength, endurance, and discipline. However, before every workout, race, game, or competition, there was a strict warm up routine that served to prepare the mind and body for what was to come. Coordination and movement were also reinforced daily. These

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14 Phelps.
routines served to prevent chronic pain and injury. It is an obvious truth that injury is a huge risk when participating in sports. Professional athletes are expected to perform well into their 30s. Musicians, however, are expected to continue well into their senior years. Why then is music not treated like a movement sport?

I discovered archery as a university student when a violinist friend of mine, who also practiced archery, invited me to attend and observe a private lesson at her instructor’s shooting range. I had always been interested in archery, so I decided to go to see if this new sport was a good fit for me. During the lesson, I started to notice just how similar the set-up, movements and overall coordination are to that of viola playing. It began to make me wonder if any of the technical exercises used to improve an archer’s performance could be applied to my performance as a violist.

Archery is an ancient art form that requires physical discipline, mental discipline, and patience. The sport also requires regular and continued practice and revision over many years. Champion and coach Larry Wise emphasizes the importance of creating a shooting objective before even picking up the bow. Every aspect of body control and how an archer shoots must be in direct relation to the shooting objective. He created a system called “Core Archery”, which focuses on the utilization of proper back tension to achieve consistent and

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15 Kempter, 9.
16 Ibid.
17 Ibid.
18 Larry Wise, Core Archery: Shooting with Proper Back Tension (publication place: Target Communications Corporation, 2004), 3.
repeatable long-term results. The utilization of proper back tension when shooting rather than using arm strength causes a natural balance of pull and decreases the changes of experiencing fatigue.

Archery Ray Axford establishes an archer’s shooting priorities by using a hierarchical system that divides the body into three sections and three priorities. Axford believes that an archer’s top priority is the power unit, which includes the spine, the rib cage, the shoulder blades, the arms, wrists, and hands. The second priority, the foundation unit, includes the pelvis, legs, and feet. The final priority is the confirmation unit, which includes the remainder of the body from the neck up. The establishment of priorities stems from an archer’s desire to shoot “good arrows.” However, shooting “good arrows” involves much more than good aim, concentration, and mental strength. Shooting “good arrows” requires that the confirmation unit is the final priority. Archery requires a great amount of physical knowledge and mastery. Brian Sorrells, like Wise and Axford, states that the most important aspect of shooting is correct form whether it be a scale or an orchestral work.

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19 Wise, 3.
21 Axford, 76.
22 Ibid.
23 Ibid.
24 Johnson, 13.
Summary

Data shows that 73.4% to 87.7% of instrumentalists experience musculoskeletal disorders that are directly related to performance.26 String players are unfortunately at the highest risk.27 Violinists and violists in this category suffer from chronic pain in their upper extremities.28 Many violists, are less concerned with mastering their kinesthetic sense as accurately as possible than they are with learning notes, rhythms, and enhancing their musicality.29 In musicians, movement and coordination are largely ignored until injury occurs. Viola players spend hours working on scales, double stops, arpeggios, bow exercises, and solo repertoire, but may devote little time revising their set-up and focusing on how they move when in the practice room.

27 Ibid.
28 Ibid.
29 Kempter, 10.
Need for the Study

There are but a few short articles that address a few of the similarities between archery and viola playing. No one, however, has published a lengthy professional document detailing the in-depth physical comparison between the two disciplines and applied the movement exercises utilized in archery pedagogy and performance to viola playing. A strong understanding of movement and coordination within archery technique and pedagogy can give viola players a vital and unique perspective on how to play the instrument and how to frame the important physical and mental aspects of viola technique to avoid discomfort and injury.

This essay synthesizes and applies fundamentals of archery technique and pedagogy to viola performance by prioritizing the physical aspects of playing and promoting the use of proper back tension. The essay will help viola players better understand the physical variables of performance in a way that will avoid discomfort and injury and allow viola players to view concepts that they already know from a unique perspective.

Musicians move for a living, so it is vital that they not only make physical wellness their top priority, but also understand why physical wellness is important. This essay will explore the common injuries that occur among viola players and analyze some of the risk factors that can directly attribute to these issues. This is accomplished partially by examining a variety of studies showing the statistics of musculoskeletal disorder among viola players and the areas that are the most commonly affected. The essay will also examine the common
tendencies in viola players that can lead them away from natural body movements and coordination and instead cause tension and injury.

The essay examines the most effective approaches that archery instructors use to refine a student’s setup based upon the individual’s specific anatomy and apply that to the set-up for individual viola players. It will consider how archery instructors factor in the age, size, body type, and sex of the student when modifying setup and working on coordination.

Prepubescent males and females have very similar skeletal and muscular structures. 30 Once they reach puberty, not only are they growing, but their bodies conform to the standards of their biological sex. 31 Males have a much broader shoulder girdle and rib cage and on average more muscle mass. 32 Females have a lower center of gravity, a higher degree of flexibility, and a deeper and broader pelvis that tilts forward. 33 This pelvic tilt causes the small of a female’s back to become slightly more concave when she is in an upright position. 34 The sexual dimorphism exhibited in males and females must be considered when discussing coordination and set-up revision as viola players. This essay will consider the shooting process for both male and female archers and translate it into a way that will aid a viola player with his or her coordination.

Finally, the essay examines how archery instructors factor in a student’s height and body type when modifying setup and working on coordination.

Although both archery and violists players to take body type into account the way

30 Axford, 38.
31 Ibid.
32 Ibid.
33 Ibid.
34 Ibid.
archers do rather than just looking at height as a variable. The essay will utilize the archer’s perspective to teach violists how to redistribute their body tension in a way that does not fight their natural design, so they can correct the damage that has been done and prevent this damage from re-occurring in the future. The essay accomplishes this by providing visual examples of the most important muscle groups used by archers and violists and showing the range of motion for the wrists, upper arms and shoulder blades.

**Purpose Statement**

The purpose of this essay is to describe, synthesize, and apply fundamentals of archery technique and pedagogy to viola performance by prioritizing the physical aspects of playing and promoting the use of proper back tension.
Chapter 2

Literature Review

The publications and literature used for this essay are divided into two parts - related archery literature and related violin/viola literature. The selected archery literature covers elementary set up, detailed descriptions of the shooting process, proper muscle memory and the specific training process. The selected strings literature covers overuse syndrome by violinists and violists, the causes of overuse syndrome and the best approach to avoid unwanted tension and injury.

Related Archery Literature

In archery literature, movement, physical health, coordination, and the need for basic knowledge regarding the human anatomy are given top priority. Many authors are major competition winners who then began teaching. The focus of such literature is typically experiential and contains detailed pedagogical descriptions of personal approaches to executing a well-intended and successful shot, as well as, how to avoid injury. Further attention is given to properly preparing for a shot, executing a shot and the common mistakes made in the process. Many of the conclusions drawn by these pedagogues are the result of trial and error, both as archers and as instructors.

In their personal teaching method, KiSik Lee, Olympic and world companion, and Tyler Benner, his student, detail the common errors that can lead to a poor shot, fatigue, and injury.\(^{35}\) Larry Wise, like Lee, is a world champion

archer, an international coach, and archery pedagogue. His method centers around what he calls “core archery”, a system of archery form that he calls both “complete and repeatable”. Core archery focuses on the utilization of proper back tension to achieve consistent and repeatable long-term results. Wise believes success in archery can be achieved by creating a shooting objective.

“When you get in your car, start it and drive down your driveway or street, you usually have a destination in mind. It’s not often we just drive around without going ‘somewhere.’ Few contractors I know build houses or other buildings without a plan or blueprint…Taking archery seriously means that you must organize what your body is doing prior to releasing the arrow. At the highest performance level, archery is all about how you control your body and mind…”

Archery pedagogue Brian Sorrells teaches that the single most important aspect of shooting is utilizing correct form. His personal method details the many determinants that can lead to proper and improper form. For example, fatigue can lead to shooting inefficiencies.

“Shooting while fatigued can lead to bad habits like ‘short drawing’ the bow—not coming full draw before releasing the arrow.”

His method also explains the vitality of selecting the proper equipment for each individual. When choosing a bow, Sorrells emphasizes the importance of handling the bow and drawing the bow as many times as possible. He also details proper shooting technique, which involves an archer’s stance, grip, draw, steady bow arm, anchor and anchor point, sight picture, breath control and

36 Wise, 1.
37 Ibid, 3.
38 Sorrells, 1.
39 Ibid, 2.
40 Ibid, 7.
Ray Axford’s method focuses on the application of knowledge of the human anatomy to archery performance, taking into account the importance of taking an individual’s size, sex, and body type. He describes a strict hierarchical system that separates the body into three major parts or priorities in a way that allows an archer to consistently hit the desired target while properly maintaining a well-balanced shooting form. These three priorities in order include the power unit, the foundation unit, and the confirmation unit. The power unit includes the spine, the rib cage, the shoulder blades, the arms, wrists and hands. The foundation unit includes the pelvis, legs and feet. The final priority, the confirmation unit, addresses the body from the neck up. The power unit is addressed first, because the majority of an archer’s movement comes from the upper body. The confirmation unit is addressed last, because taking aim is the final step needed before releasing the arrow.

The Federation Internationale De Tir A L’arc, also known as FITA, has analyzed archery from the perspective of sports medicine and science. FITA’s medical data includes a kinesiological analysis of the sport, the muscles, joints, and tendons utilized when shooting, proper muscle control, determinants that effect performance, injuries within junior and senior archers, and the effects of nutrition on archery performance.

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41 Sorrells, 57.
42 Axford, 76.
43 Ibid.
44 Ibid.
Finally, Ashley Kalym emphasizes the importance and vitality of physical fitness as an archer.

“Archery is a skill-based sport, and physical training is something that is overlooked in exchange for skill development, shot execution, mental strength building, and other factors relating directly to the shot.”

Kalym focuses on bodyweight and weighted exercises that are heavily influenced by physical fitness training. He believes that many aspects of weight training can allow archers to maintain a proper technique while increasing endurance, strength, and overall physical health.

**Related Strings Literature**

The high rate of performance related injuries in string players and other instrumental musicians is well-documented. The publications contain statistics and past studies done on instrumental musicians, in general, but others focus specifically on violinists and violists. Studies identified by the National Institutes of Health categorized and studied violinist and violists specifically as a single group noting

“Violinists and violists often suffer from conditions in the jaw, back, neck, shoulder and hands, which can be either nerve related or muscular.”

Some pedagogues go back to the basics to aid performers in achieving proper body control that will lead to more effective practice, better technique, and little to no fatigue. Many of these pedagogues speak on behalf of personal

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experience when teaching and playing when they were students.

In her personal method, violinist and upper strings pedagogue, Jennifer Johnson, discusses the importance of body wellness and keen sense of kinesthetic knowledge for violin and viola players. Her method states that human beings have a natural kinesthetic sense in addition to the other five senses and that a learned suppression of this sense can lead to chronic pain and injury. She further says that many people suffer from one of two major postural issues, the “relaxation disease” and the “good posture disease.” These diseases are learned and are entirely cultural.  

Johnson identifies the places of balance within the body, including the atlanto-occipital joint, arm balance, lumbar core, the knee joints, and ankle joints. She highlights the common postural errors, which she calls “body-mapping” errors, associated with each area and properly maps them. Her works focuses on debunking common “body-mapping” errors.

Susan Kempter’s publication suggests that many violin and viola pedagogues focus entirely on the musical product being produced. Often as a result, they ignore a student’s physical health until a problem arises. She emphasizes that a student’s physical setup must be the first and only priority and that making music cannot begin until physical setup is mastered.

In regard to playing-related disorders among musicians, the CiOS (Clinics in Orthopedic Study) team at the NIH, divides violin and viola “stress-inducing movements” data into two categories: 1) isotonic movements, which are

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47 Johnson,  
48 Ibid.
sophisticated and fast movements designed to produce sound (e.g., touching the fingerboard and bowing); and 2) isometric movements, which serve to stabilize the instrument for prolonged periods in unstable postures.\textsuperscript{49}

Both violinists and violists frequently complain of upper neck and extremity problems. The CiOS identifies the specific, individual movements of these players that cause problems.\textsuperscript{50}

**Research Questions**

The literature review details the literature and publications taken from archery experts and string pedagogues. The selected archery literature revolves around the testimony and training techniques of some of the most respected archery pedagogues. These pedagogues discuss elementary set up, detailed descriptions of the shooting process, proper muscle memory, ranges of motion, physical training and most importantly the utilization of proper back tension.

The selected strings literature centers around the recovery techniques of a variety of violin and viola pedagogues who have either helped their students recover from overuse syndrome or have experienced injury themselves. Their literature covers overuse syndrome, how to avoid unwanted tension, and some of the risk factors that can be directly linked to overuse syndrome.

To identify the similarities between the movements utilized by archers and viola players the following questions must be addressed and answered:

1. What is the direct cause of musculoskeletal disorders within viola

\textsuperscript{49} Lee, 420
\textsuperscript{50} Ibid.
players and what are some of the risk factors attributed to them?

2. How is the elementary setup for archers and viola players directly related?

3. How can an understanding of proper upper back tension benefit viola players?

4. What are some of the warm-ups and strength-training exercises that archers use in their training process and how can they benefit viola players?

5. How can viola players use aspects of archery pedagogy to approach tension redistribution?
Chapter 3

Musculoskeletal Disorders Within Violists

The human body is extremely resilient even when exposed to increased physical activity. During normal amounts of physical activity, miniscule injuries can still occur within muscles, bones, tendons and ligaments and acute injuries like a pulled muscle or even a broken bone can result from a just single stressful event. It is, however, vital that an individual experiencing these small aches and pains take the time to re-evaluate and re-examine their movements and make the changes necessary to promote healthy and correct movement, coordination and breathing. In many cases, artistic techniques are not being executed correctly and when they are repeatedly applied incorrectly over an extended period, they can lead to overuse syndrome and a variety of other musculoskeletal symptoms and diseases.

It is common for both amateur and professional violinists and violists to suffer from stiffness, pain and injury. 51 Many studies show a high prevalence of musculoskeletal injuries and disorders occurring with instrumental musicians and that the highest numbers occur within string players. 52

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51 Lee, 420.
52 Ibid.
These studies show that at least 75% of string players experience pain and injury within their upper extremities. The data from these studies also shows that most of the issues occurring within the upper extremities were directly related to overuse due to incorrect application while performing.

A study conducted by researcher Roset-Llobet showed that almost 80% of the instrumentalists he studied had musculoskeletal disorders that were directly related to music performance. Another similar study conducted in Korea also showed that almost 80% of orchestral and symphony musicians were suffering from performance related musculoskeletal disorders the most frequently affected

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53 Lee, 420.
54 Ibid.
55 Ibid.
56 Ibid.
body parts were the shoulders. In this study, 59.6% of the participants complained about shoulder pain and 48.1% complained about back pain.

These statistics do not occur because playing a violin or viola is inherently harmful. Violinists and violists often suffer from upper extremity pain and musculoskeletal disorders because of how they move when they play the instrument and then how they approach treatment once a problem arises.

Unfortunately, 90% of all patients that suffer from overuse syndrome or other musculoskeletal diseases will experience the same symptoms again within a brief period of time. This reappearance of symptoms occurs because technical revisions are not made, and tension redistribution is largely ignored because the problem appears to be gone. The effect of the problem is being tackled but the root of the problem remains untouched and not addressed.

Although violinists and violists players don’t necessarily ignore the physical aspects of playing, they forget that playing an instrument is a movement sport and should be treated as such. Violists need to begin treating performance like a movement sport, because they move for a living. If movement and the utilization of proper back tension do not become the first and top priority, these statistics will never decrease.

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57 Lee, 420.
58 Ibid.
59 Ibid.
61 Kalym, 9.
Risk Factors within Performance World

Poor playing conditions are nothing new to the working violist. Often comfort, technique and physical wellness are sacrificed for the sake of good ensemble and steady income.\(^{62}\) String players are often forced to rehearse and perform with very limited space, terrible chairs and poor lighting for an extended period.\(^{63}\) Violists are often placed in the middle of the orchestra. When space is limited, they often find themselves struggling to find adequate bow room, so they have to maneuver themselves or crank their necks to get a clear view of the conductor, the principal violist and the concert master.

Orchestral musicians often have just a few lengthy rehearsals before a professional big performance or recording session. Many of these musicians perform with multiple groups in just a single day.\(^{64}\) These lengthy rehearsals always require a high amount of focus and perfectly polished playing. The need for perfection within a very brief time span requires performing musicians spend many hours outside of their rehearsals learning, practicing and polishing massive amounts of repertoire. This leaves limited time for rest, recovery, and revision.

A violist’s warm up usually consists of scales, double stop exercises and bow exercises. Music is meant to be enjoyed by the ears, so a violist’s goal is to produce a perfect auditory experience. Violists, however, move for a living.\(^{65}\) Their direct focus is almost entirely on the left and right-handed techniques and sound production, and, unfortunately, their physical wellness is largely ignored.


\(^{63}\) Ibid, 18.

\(^{64}\) Ibid.

\(^{65}\) Johnson, 10.
This negligence occurs because the physical aspects of performance, set-up, and revisions only take priority during the first one to two years of playing, which can ultimately lead to the downfall of a violist’s physical comfort and even his or her career.

**Ganglion Cysts**

Ganglion cysts are a condition in which benign cysts begin to grow on the fingers, hands or wrists and can both limit activity and compress nerves. These cysts are caused by prolonged overuse syndrome.

**Shoulder Injuries**

The trapezius and rotator cuff muscles are the most at risk for both professional and amateur violin and viola players. This is because these specific musicians both tend to raise their right shoulder and push it forward. When this faulty movement undergoes excessive repetition, it can reduce blood supply, which can then cause inflammation and tears in the rotator cuff muscles.

Tendonitis is one of the most common shoulder related injuries amongst string players and is caused by excessive repetitions at or above shoulder level. Although pain in the trapezius area is not uncommon, the rotator cuff muscles are the prime targets for tendonitis. These excessive repetitions can also result in a

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66 Kempter, 8.
67 Horvath, 72.
68 Ibid.
69 Ibid, 42.
70 Ibid.
71 Ibid.
pinched bursa when the rotator cuff and the bursa found within the shoulder blade pinch are squeezed together.  

Excessive repetition and overuse can also lead to the severe loss of motion within the shoulder area and excessive inflammation in this area can even put both violinists and violists at risk of frozen shoulder.  

Symptoms include stiffness and difficulty sleeping on the area. Performance related frozen shoulder is caused when these string players move incorrectly and begin to overcompensate with other parts of the body. When a violinist or violist loses mobility in the shoulder, he or she may begin to overcompensate with other parts of the body furthering the problem even more. Some patients recover but may never be able to utilize their full range of motion.

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72 Horvath, 42.
73 Ibid, 43.
75 Ibid.
76 Ibid.
Carpal Tunnel Syndrome

“The flexor tendons are fibrous bands that attach the flexor muscles to the elbow and finger bones. The flexor muscles and tendons bend the fingers, to make a fist, for example. The median nerve is a long nerve originating in the neck. It travels down the arm into the hand. Both the median nerve and the flexor tendons must pass through a narrow tunnel at the wrist called the carpal tunnel. As the fingers move, the tendons slide against each other.”

Exaggerated wrist positions can result in carpal tunnel syndrome. Viola players need to make sure that their wrists remain within the neutral area of their range of motion. Deviated and dropped wrists can cause the flexor tendons to

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77 Horvath, 67.
78 Ibid, 56.
become inflamed compressing the median nerve. Figure 29 pictures the flexor muscles, which are attached to the elbow by the flexor tendons.

**Focal Dystonia**

Focal dystonia is known to be one of the most serious performance-related musculoskeletal disorders and one of the most difficult ones to cure. Symptoms include uncontrollable muscle contractions within a single and specific part of the body and are the direct result of forced repetitive movements that are sustained over an extended period. One of the most common symptoms within string players are uncontrollable movements within their left fingers. Focal dystonia is one of the rarer musculoskeletal diseases only occurring in 1% of professional musicians. However, only about 40% of the musicians who suffer from the disease will be able to continue performing even after receiving treatment.

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79 Horvath, 56.
80 Ibid.
81 Lee, 420.
82 Ibid.
83 Ibid.
84 Ibid.
85 Ibid.
Creating a Goal, Objective, and Strategy for Archers

Archers and viola players both have set goals and desired outcomes. An archer’s goal is to consistently hit the target and shoot for longer with little to no fatigue. A violist’s goal is consistently play with good intonation and a good sound with little to no fatigue. However, many violists play with discomfort and experience daily fatigue. In order for these string players to achieve their goal, it is important for them to reevaluate their objectives and strategies in a way that will put the physical aspects of playing first.

For an archer’s arrow to reach its desired destination, it must travel from point A to point B. However, it is not as simple as look, aim and shoot. The shot, like many other tasks, requires a carefully designed and well-thought out blueprint. This blueprint outlines every process of the shot so it can be structured, analyzed, and edited before even picking up the bow.

When drivers get into the car, they may have a destination in mind, but they must also have a checklist of things that need to be addressed before putting the car into drive. A driver must first adjust the seat, buckle the seatbelt, check the mirrors, enter the destination into his or her GPS, and put the keys into the ignition. A driver will go through this same routine every time he or she gets in the car.

The approach of creating a goal, objective, and strategy is an archer’s foundation. It requires an end goal, a primary objective, and a shooting strategy. It
is an archer’s job to engineer this blueprint before every shot he or she takes and analyze each step of the shooting process from shot preparation to the follow through that occurs after the arrow is released.

Ultimately, the goal of every archer should be to hit the target and become skilled in his or her craft. An archer’s objective should be to hit his or her desired target on a consistent basis while utilizing proper back tension.

“Archery is not about bows and arrows, it’s about you and your ability to control your body consistently to achieve a desire outcome.” 86

After making the shot, an archer must then revise his or her blueprint to note what went well, what went wrong, and why. By reflecting on the most recent shot taken and strategizing before an upcoming shot requires, the archer asks himself or herself a few important questions.

“If you didn’t hit the middle, did you have bad form? If you believe that you had good form, how do you know? By what standard are you measuring your form steps? What objective in your form are you not meeting when you miss (Wise, 4). 87

It is vital that an archer learns, understands and practices the shot with perfect form, especially as a beginner.88 A solid blueprint and foundation will allow the beginning archer to grow in his or her technique and gain more success as a shooter. 89

86 Wise, 4.
87 Ibid.
88 Sorrells, 57.
89 Ibid.
Elementary Shooting Form for Archery

Step 1: Use an open stance with both feet aligned with the shoulders
Step 2: Raise both arms with palms facing up
Step 3: Allow both hands to rest on the top of the collarbone.
Step 4: Fully extend the bow arm out to the side
Step 5: Turn head over the bow shoulder. Be sure that the torso does not turn with the head
Step 6: Bring the shooting elbow up into anchor position. Be sure to refrain from raising the shoulder.

Figure 3. Elementary Shooting Form Steps 1-3

Anthony Camera, Shooting the Stickbow: A Practical Approach to Classical Archery, 2nd ed. (College Station: Virtualbookworm.com Publishing Inc., 2010), 37.
Blueprint for Viola Players

Violists also require that same blueprint. They have a final goal and require a set of steps they must take to get them there. They want to perform their pieces with good intonation and a good sound. Additionally, they aim to hit all the correct notes, properly execute the correct bow stroke, play with fast fingers, have variation within their vibrato, and much more. However, before beginning, violists should always have a mental checklist and a hierarchy for their priorities.

Although violists have a checklist, it is mostly musical, such as singing the first few measures before beginning. However, many violists do not have a physical checklist beyond making sure the bow is set properly on the string. This lack of a physical checklist is unfortunately because the physical aspects of

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92 Ibid.
performance, set-up, and revisions only take priority during the first one to two years of playing. 93 When the mental and musical aspects of viola performance become the first priority on that checklist, musicians will find themselves improperly balanced and playing through discomfort and pain.

**Elementary Set Up for Viola Players**

Step 1: Stand with both feet aligned with the shoulders

Step 2: Raise both arms at an angle with palms facing up

Step 3: Rotate left elbow so the left arm and hand are facing straight up with the palm facing backward

Step 4: Extend the left arm until it is just beyond a 90-degree angle

Step 5: Extend the right arm only about half way while keeping the palm facing down

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93 Kempter, 8.
Figure 5. Elementary viola set up

Figure 6. Elementary viola set up: Final position
When an archer sets his or her arrow in place on the string it is referred to as nocking the arrow. Nocking the arrow is the archery equivalent to a string player placing his or her bow on the string.

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94 Wise, 31.
When a string player places the bow on the string, he or she uses the natural weight of the arm to keep the bow in place on the string and let the bow hairs grip the string without having to apply forced pressure. Although nocking the arrow is one of the easier steps of the shot process, it allows the archer to begin mentally preparing for the remainder of the shot cycle.  

**Raising the Archer’s Bow**

Once the arrow is nocked, the archer is ready to raise the bow and move into setup position. During the process of raising the bow, it is vital that the archer maintain a natural position by refraining from raising his or her shoulders while setting the bow. 

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96 USA Archery, 34.
setting a position referred to as the “barrel of the gun”\(^\text{97}\). The barrel of the gun describes an archer’s bow alignment moving from the bow hand to the drawing shoulder. \(^\text{98}\) When setting the barrel of the gun, it is vital that the archer refrain from compromising his or her natural position. One of the biggest mistakes an archer can make when setting the barrel of the gun is to rotate his or her shoulders inward. \(^\text{99}\) When an archer raises the shoulder and rotates the shoulder inward, the head of the humerus bone moves out of the glenoid socket, the socket that connects the humerus to the scapula, and prevents contact between the two bones. \(^\text{100}\) This lack of contact between the humerus and the scapula causes the archer to rely almost entirely on the physical power of their arms and shoulder muscles and compromises the utilization of proper back tension.

**Executing the Draw, Anchoring, and Holding**

The draw takes place when the archer utilizes back tension to move from set position to the anchor position and is also where the most noticeable movements occur within the shooting process. \(^\text{101}\) However, anchoring and holding are equally as important and utilize the same muscle groups and the same control as that of the draw.

Anchoring is a crucial step during the shooting process. \(^\text{102}\) When anchoring the archer’s bow, an archer must maintain the load placed on the trapezius muscles while also raising the draw hand and arm to reach the

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\(^{97}\) USA Archery, 35.
\(^{98}\) Ibid.
\(^{99}\) Ibid, 46.
\(^{100}\) Ibid.
\(^{101}\) Ibid, 37.
\(^{102}\) Ibid, 39.
During the anchor, the archer must also make sure to keep his or her hook and finger pressure on the bow string to further increase back tension.

Holding the archer’s bow is a crucial step in the shooting process. Properly executing the hold allows the archer to shoot utilizing proper back tension every time and avoid injury. It is important that an archer waits until he or she has maintained the holding position before taking aim. This allows the archer to utilize an angular drawing motion rather than a linear one that can increase his or her chances of a shoulder injury.

It is critical that an archer understand the direct forces that affect back tension and ultimately these vital steps within the shooting process. These forces include the spine, the rib cage, the shoulder blades, the back muscles, and breast muscles. Other critical areas that affect these steps will include the arms, wrists and hands. An archer’s primary objective is to hit his or her desired target on a consistent basis while utilizing proper back tension. Therefore, it is vital that the back, back tension, and the surrounding areas that are directly linked to proper back tension must be an archer’s first and top priority.

The most noticeable movements that violists make are in the upper half of the body. Therefore, the back, shoulder blades, arms, wrists and hands should always be a violist’s top priority. Notes, rhythms, intonation, tone, musicality,
bow distribution and bow strokes should always come afterwards. Therefore, it is critical that violists understand how their upper bodies are designed and how they move.

**Utilizing Proper Back Tension**

Understanding what the basics of set up and movement should look like is important, but it is even more vital that archers feel tension in key areas of the body to confirm that the movements are being executed correctly.\(^{110}\) In the music world, the term ‘tension’ has negative connotations. It commonly associated with pain, fatigue, and injury. However, the utilization of proper back tension is the key to an archer’s success.\(^{111}\) Without it, it would be impossible to make a perfect shot.\(^{112}\) For this reason, back tension is a common topic within the field of archery.\(^{113}\)

If an archer wishes to draw a bow, regardless of the weight of the bow, it is vital that he or she use the muscles of the upper back instead of the biceps during the draw.\(^{114}\) This will not only significantly reduce fatigue, but it will also allow for a proper follow-through.\(^{115}\)

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\(^{110}\) USA Archery, 32.

\(^{111}\) Wise, 6.


\(^{113}\) Ibid.

\(^{114}\) Ibid.

\(^{115}\) Camera, 267.
Shoulder injuries are one of the most common complaints that violists bring to medical professionals. This is because viola players tend to raise the right shoulder and push it forward causing unnecessary tension, limited mobility, and fatigue. When shoulder movements are limited, this causes the violist to employ the arm more than the back muscles.

116 Axford, 35.
117 Horvath, 41.
The shoulder and upper back area is very complex, and it meant to be flexible. Back tension is the contraction of the dominant or drawing-side rhomboid, aided by the levator scapulae muscle, which causes a micro sliding-rotation of the scapula toward the spine. These are top layer muscles that are easy to see and feel both during the shot process and when trying to promote muscle memory when an archer is revising a shot or a string player is moving their bow. The top muscles of the back include the trapezius muscle, the latissimus dorsi muscle, and the sternomastoid muscle. These top layer muscles can be easily found by an archer and his or her coach both visual and by touch. The ability to easily find these muscles makes revisions in both movement and use during the draw significantly easier to tackle.

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118 Horvath, 41.
119 Axford, 35.
120 Ibid.
“While the rhomboids and levator scapulae muscles are contracting, the trapezius muscle also contracts, locking unit with the scapula, keeping them both close to the rib cage, and moving the draw-arm and hand enough to cause a release aid or a draw check device to activate. There it is. That’s the true objective of a good form every time you nock the arrow. Every piece of your form must be geared to setting up the proper execution of back tension. If not, then whatever you’re doing is wasting energy or working against your performance. Worse, it can damage your body, for which you’ll pay later.\textsuperscript{121}”

Figure 11. Top layer muscles \textsuperscript{122}

Figure 11 shown above pictures the top layer muscles utilized by archers during the shooting process. These muscles are relatively easy to see and feel. The sternomastoid muscle can be found by touching the base of the skull underneath and behind the ear. It functions by pulling the head from side to side aiding in head turning movements.\textsuperscript{123} The latissimus dorsi is a large muscle that extends from the lower part of the shoulder blade and humerus bone down to the lower

\textsuperscript{121} Wise, 7.
\textsuperscript{122} Axford, 35.
\textsuperscript{123} Ibid.
back connecting the spine to the pelvis. However, the most important back muscles utilized by archers are the rhomboids, the levator scapulae, and the rather large trapezius muscles.\textsuperscript{124} The trapezius muscle is found on the back of the neck as well as the shoulder blade area. This muscle functions in raising the shoulders and pulling the shoulder blades towards the spine making it one of the most vital muscles used when executing the draw.\textsuperscript{125} The Bowfit Archery Exerciser is an excellent tool for invented by a physical therapist that practices archery that is designed to simulate the action of drawing a traditional bow.\textsuperscript{126} This devise is designed for those who aim to increase their physical strength when shooting while also improving their form.\textsuperscript{127} This is often one of the most common areas of discomfort for violists.\textsuperscript{128}

![Diagram](image)

\textbf{Figure 12. Anchor Position (Aerial View)\textsuperscript{129}}

 Similar to the way archers use the top layer muscles of the upper back region when executing the draw, violists should also utilize proper back tension

\textsuperscript{124} Wise, 5.
\textsuperscript{125} Axford, 34.
\textsuperscript{126} Sorrells, 45.
\textsuperscript{127} Ibid.
\textsuperscript{128} Horvath, 41.
\textsuperscript{129} Axford, 36.
when drawing the bow. Figure 13 shows a violist from behind while executing the draw. This image shows the right shoulder blade being pulled towards the left shoulder blade to where they almost meet in the middle. This same motion can be seen being executed by the archer in Figure 12. It is important to note that the movement is not overly exaggerated. If the movement is forced and over exaggerated it may cause the violist to try and push the shoulders back, force the chest out and hyperextend the spine.

![Figure 13. Bow at the frog, in the middle and at the tip](image)

**Ranges of Motion**

Figures 14 and 20 demonstrate the archer’s range of motion for the wrist, the upper arm and the shoulder blades. However, the motion of any body part at the joint is most comfortable at the middle range. When movements within the extremes of an area’s range of motion are overused within the extremes of that range, it causes unnecessary tension and fatigue.

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130 Camera, 267.
132 Ibid.
Figures 15-16 demonstrate the proper position of the wrist for both and archer’s bow hand and draw hand. Although the wrist may not be perfectly straight, it remains within the middle of its range of motion. If the wrist was to lean towards any of the two extremes, it would inhibit technical progress as well as promote tension and stress.  

Figure 15a. Archer’s bow hand

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133 Axford, 3  
134 Kempter, 42.
Understanding the wrist’s range of motion is equally as important to viola performance. Figure 17 displays the correct placement of the wrist for the left

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135 Wise, 23.
hand. If the instrumentalist uses the upward and downward extreme of the wrist’s range, the wrist then becomes at risk of locking causing unnecessary tension.  

It is equally as important for violists to understand the concepts of ulnar and radial deviation. Ulnar and radial deviation encompass the side-to-side range of motion for the wrist. Ulnar deviation occurs when the wrist and hand is turned towards the ulna bone that is found within the within the forearm. Radial deviation occurs when the wrist and hand is turned towards the radius bone that is found within the forearm. The majority of the time that a violist is using the bow, he or she should remain within the middle area of the range of motion as seen in Figure 43. Figure 18 show the violist’s wrist position when at the from, which is the very bottom of the bow. Figure 19 shows the viola bow placed at the

137 Kempter, 42.
138 Ibid, 56.
139 Ibid.
tip. It demonstrated that even when the violin bow is at the tip, the wrist should not be exhibiting ulnar deviation and should also not be at its downward most extreme. Only when the violin bow is placed at the very tip should the wrist be leaving the middle range of motion. Although this is the case when the violin bow is at the very tip, the wrist should not be at its upward most extreme.

![Figure 18](image1.png)

Figure 18. Violist’s right-hand position at the frog

![Figure 19](image2.png)

Figure 19. Wrist position at the very tip
Figure 20 displays the archer’s range of motion within the upper arm and shoulder blade. When the archer is in full draw position, as shown in Figure 21, the upper end of the archer’s range of motion is being utilized. When at full draw, the elbow should be raised high. However, it is important to note that the shoulder not be raised or pushed forward. An archer’s elbow placement is always determined by the height of his or her arm and never the shoulder.

Figure 21. Holding Position (Front View) \(^{140}\)

The archer is using the upper end of the shoulder’s range of motion yet is refraining from raising his shoulder or pushing it forward.

Figure 20. Range of motion for the shoulder and the upper arm \(^{141}\)

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\(^{140}\) Axford, 87.  
\(^{141}\) Ibid, 27.
Figure 22. Range of motion for the shoulder and the upper arm

Figure 23. Archer’s full draw shoulder and elbow position

- Raise the draw hand straight up into the air
- Drop the arm above the elbow so the pinky finger is resting just below the chin
- Rotate the forearm so that the palm of the hand is facing the neck
- Turn the head to face the wall

Although violists will not be using the higher end of the upper arm’s range of motion, it is equally as important to note that the shoulder should never be raised or pushed forward. Shoulder injuries are one of the most common

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complaints that string players bring to medical professionals. Raising the shoulder causes unnecessary tension and limits the musician’s mobility. When shoulder movements are limited, this causes the violist to employ the arm more than the back muscle and may even tempt the performer to begin swinging his or her arm back and forth.

**Taking Aim**

Aiming for the target is the final step in the draw process and will always remain the last priority on an archer’s list of things to do before releasing the arrow. This order may seem backwards because the average person would assume that an archer would take aim before lining up the shot. However, taking aim does not contribute to the development of the shot and is therefore always put last on an archer’s list. Aiming is last on the list, because shooting an arrow is done with the body and the vast majority of the shooting process is physical rather than mental. Therefore, the physical aspects of the shot must take priority or else the arrow will never hit the desired target.

This strict hierarchy should be no different when a violinist or a violist is practicing or performing whether it be a scale or an orchestral work. Musicians work very hard to train their auditory and visual senses and for good reason. This aural training is necessary because when a musician is practicing and performing, he or she has a lot to think about including playing the correct notes, stage presence, producing a good tone, phrasing, bowings, dynamics and other

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143 Horvath, 41.
144 Axford, 76.
145 Ibid, 140.
146 Johnson, 13.
accidentals written on the page. However, it is common for musicians to allow the visual and auditory aspects of practice and performance to become their top priority. 147

**The Follow-Through**

The follow-through occurs after the archer releases the arrow. However, it is still an important part of the shooting process. During the follow through, the archer continues to steadily pull the draw hand backwards while the bow arm remains steady and in shooting position.148 The follow-through is the archer’s equivalent of ending a phrase. If the archer allows his form to completely collapse the second his fingers release the arrow, he will ruin his entire shot in the same way a violist can ruin an entire phrase by neglecting to play through the phrase or immediately dropping into rest position after releasing the bow from the string.

147 Johnson, 13.
148 Sorrells, 66.
Chapter 5

Warm-Up and Strength-Training Exercises

An archer’s goal when warming up before a shooting session should be to wake up the central nervous system.149 The central nervous system wakes up when blood flow increases to the muscles.150 When string players think of warming up, scale, arpeggios and bow exercises typically come to mind. However, warming up the body should always be a musician’s first step before even touching the instrument. The following warm-up exercises are designed for archers to promote healthy movement and wake up the body. These exercises will help string players to do the same.

Static Stretching

Static stretching, holding a stretch for between ten and thirty seconds, should be avoided until after a shooting session.151 Static stretching can lead to too much elasticity within the muscles, which can cause injury.152 Excessive elasticity does not always support the joints.153

150 Ibid.
151 Ibid.
152 Ibid, 33.
153 Ibid.
V-Bar Warm Up\textsuperscript{154}

Items Required: V-bar

- Take hold of the v-bar with one hand and do five large circular backward arm motions. Switch arms and repeat
- Repeat step one using forward arm motion. Refrain from rolling the shoulders forward
- Repeat step two but this time moving across the body in a horizontal figure eight. Refrain from moving the shoulders forward

Figure 24. V-Bar Warm-up\textsuperscript{155}

\textsuperscript{154} Kaminski, 33.
\textsuperscript{155} Ibid.
Up, Over and Back\textsuperscript{156}

Items Required: Stretch Band

- Take the stretch band and stretch it out with both hands
- Try to extend the arms far apart but to allow a slight bend
- Reach up with the band extended and move the arms backward until they are behind the head and level with the neck
- Keep the band extended and move the arms back over the head until they are just below eye level
- After repeating four to five times, add a back bend once the arms are behind the head
- Repeat three to five times

Foam Tube Warm-Up\textsuperscript{158}

Items Required: Foam tube and two stability disks

- Place each foot on a stability disk and use an open stance
- Take the foam tube and place each palm at one end of the tube
- Raise both arms and the foam tube to where they reach shoulder level
- Rotate each direction and hold position for around five seconds
- Repeat 3-5 times

\textsuperscript{156} Kaminski, 34.
\textsuperscript{157} Ibid.
\textsuperscript{158} Ibid, 36.
Figure 26. Foam Tube Warm-up: Step One

- Take the foam tube and position it so that one end is touching the chest
- Raise both arms and the foam tube to where they reach shoulder level
- Rotate each direction and hold position for around five seconds
- Repeat 3-5 times

Figure 27. Foam Tube Warm-up: Step Two

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159 Kaminski, 37.
**Draw Simulation Exercise** 161

**Items Required:** Two stability disks and a stretch band

- Take the stretch band in both hand and raise the arms to where they reach shoulder level
- Move one of the arms out to the side while keeping it at shoulder level and turn the head so that it is staring directly at the hand.
- Place the other arm behind the head and bend the arm at the elbow to where the hand is positioned just above the neck
- Contract the back muscles and slowly lower the bent arm

![Figure 28. Draw Simulation: Steps One and Two](image)

- Extend the bent arm so that both arms are fully extended out to the side with the stretch bad behind the head
- Take both ends of the stretch band into one hand
- Get into set position and raise both arms until they reach shoulder level
- Use back tension to rotate the draw shoulder blade closer to the other shoulder blade
- Slowly return to set position
- Repeat 3-5 times

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161 Kaminski, 38.
162 Ibid, 40.
Rotation Warm-Up Exercises

Items Required: Stretch Band

Rotation exercises are used to both strengthen and promote proper movement within the rotator cuff region. Violists should utilize these exercises to promote the use of proper back tension when moving the bow up and down the string. It is important for violists to remember that these exercises are meant to be executed using back tension rather than arm strength. If a violist tries using the

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163 Kaminski, 40.
164 USA Archery, 148.
arm to pull the stretch band, he or she will increase the chance of developing fatigue or raising the shoulder.

- Take hold of the stretch band with the draw hand
- Hold the draw hand at the core
- Rotate the drawing shoulder outside bringing the shoulder blade closer to meeting the other
- Once the drawing hand is pointed straight ahead, slowly bring it back to the starting position

Figure 30. External Rotation

- Take hold of the stretch band with the draw hand
- Rotate the drawing shoulder towards the core
- Once the drawing hand is at the core, slowly rotate the drawing shoulder outside back to the starting position

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165 USA Archery, 147.
Strength Training Exercises

Warming up wakes up the central nervous system. Biomechanical strength can play an immense role in an archer’s success and can also help an archer decrease his or her chances of getting injured while shooting. Muscle control also helps the body control both large and small movements. Although many violists warm up their fingers and stretch before they play, they do not really consider physical fitness to be a mandatory part of their training process. Unfortunately, physical fitness is not seen as something that can directly affect their ability to not only avoid injury but also to succeed as performers. String performance is a highly physical activity, so it is important for violists to focus on strengthening their muscles and gaining endurance.

166 USA Archery, 148.
167 Kaminski, 31.
168 USA Archery, 30.
169 Kalym, 9.
Archers use strength training to build up strength in their muscles, relieve anxiety, improve overall technique and boost confidence.\textsuperscript{170} However, it is important for archers and their trainers to take age, sex, fitness level, experience with weight training and the phase they are in within the competition year into consideration before beginning.\textsuperscript{171} Many exercises that archers utilize to gain strength and flexibility are already common and popular.\textsuperscript{172} During the off-season and pre-competition period, archers shift their focus towards technical development and strength training.\textsuperscript{173} They then shift to cardio workouts, like running, during the competition season.\textsuperscript{174} Violists can use these same training tactics by polishing their technique, revising their set up, redistributing tension throughout their bodies, and weight training during when a performance is not eminent. They should then switch their focus to cardio when coming close to a major performance.

The following strength exercises are just a few of many exercises utilized by archers that can also be used by violists to promote and provide total body wellness by strengthening muscles, increasing flexibility, reducing fatigue and improving confidence levels. They consist of both weight training exercises and body weight exercises.

\textsuperscript{170} USA Archery, 141. 
\textsuperscript{171} Ibid. 
\textsuperscript{172} Kalym, 9. 
\textsuperscript{173} USA Archery, 142. 
\textsuperscript{174} Ibid, 37.
Squats

Squats aid in strengthening the entire lower body, which as a result better stabilizes archers.\textsuperscript{175} They also help archers to increase their overall mobility and flexibility.\textsuperscript{176} To further strengthen the lower body, archers can transition from body weight squats to weighted squats. Violists also need a solid foundation unit when performing. Although most of the power and noticeable movements are coming from the upper body when performing, a strong lower body will aid in giving the upper body better support.

Items Required: Barbell and weight plates

- Stand with both feet shoulder width apart
- Keep the torso high and push the hips back while bending the knees\textsuperscript{177}
- Lower the body until the thighs are parallel to the floor\textsuperscript{178}
- Keep the heels touching the floor
- Contract the glute muscles and return the original upright position\textsuperscript{179}

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\begin{flushright}
\textsuperscript{175} Kalym, 96.
\textsuperscript{176} Ibid.
\textsuperscript{177} Kaminski, 48.
\textsuperscript{178} Ibid.
\textsuperscript{179} Ibid.
\textsuperscript{180} Ibid.
\end{flushright}
Deadlift

Deadlifts also work to strengthen the lower body. However, it is vital that the individual use a weight that is effective but is not too heavy. Using too much weight can cause the individual’s form to break down, which will promote incorrect movement and the overcompensation of certain muscles and fatigue.\textsuperscript{181}

Items Required: Barbell and weight plates

- Stand with both feet shoulder width apart
- Take hold of the barbell with both hands about shoulder width apart\textsuperscript{182}
- Push the hips back while bending the knees until reaching a vertical stance.\textsuperscript{183}
- Keep both heels touching the floor
- Lower the bar back down to the floor

Figure 33. Deadlift\textsuperscript{184}

\textsuperscript{180} Kalym, 97.
\textsuperscript{181} Ibid, 102.
\textsuperscript{182} Ibid.
\textsuperscript{183} Ibid.
Bench Press

Items Required: Weight plates

Around the Worlds

Items Required: Weight plate

The “around the worlds” exercise aids archers in gaining strength, flexibility and mobility within the shoulder area. The individual should start out using lighter weights and slowly add more weight as he or she progresses and gains more strength in the area.

184 Kalym, 102.
185 Ibid, 89.
186 Kalym, 40.
187 Kaylm, 40.
- Take a weight plate in both hands and begin rotating it clockwise around and behind the head without flipping the it.
- Continue until the plate is being held in front of the face.
- Repeat the same motion but this time counter clockwise.

Figure 35. Around the Worlds

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188 Kalym, 40.
189 Ibid, 41.
Wall Push

The wall push exercise allows archers to reinforce back tension and gain the muscle memory they need to properly execute the draw while also gaining strength in the area.\(^{190}\)

\[\text{Figure 36. Wall Push}^{191}\]

\(^{190}\) Camera, 273.
\(^{191}\) Ibid.
Chapter 6
Exercises for Tension Redistribution

When the body is trying something new and executing something for the first time, the muscles are under conscious control. The means that the mind is actively controlling certain muscles rather than going into autopilot mode. Active control is needed when muscle memory for that specific movement has not yet been developed and solidified.

**Closed Loop Movements**

When an archer or a violist is actively aware of what they are doing and how they are moving, it becomes easier for the individual to adjust what they are doing to obtain the desired result. One way to approaching a new muscle combination or movement is to think of the training process as having a circular pattern in which the individual is constantly refining their movements to eliminate any possible errors.

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192 Kempter, 70.
193 Ibid.
194 Ibid, 72.
195 Ibid, 71.
Sexual dimorphism

Aiming for the target is the last step in the draw process and will always remain the last priority on an archer’s list of things to do before releasing the arrow. Aiming last may seem backwards because the average person would assume that an archer would take aim before lining up the shot. However, taking aim does not contribute to the development of the shot and is therefore always put last on an archer’s list. Shooting an arrow is done with the body and the vast majority of the shooting process is physical rather than mental. Therefore, the archers and archery pedagogues give the physical aspects of archery top priority.

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196 Kempter, 35.
197 Axford, 76.
198 Ibid, 140.
This hierarchy should be no different when a violist is practicing or performing whether it be a scale or an orchestral work. Musicians work very hard to train their auditory and visual senses and for good reason. This is because when a musician is practicing and performing, he or she has a lot to think about including playing the correct notes, stage presence, producing a good tone, phrasing, bowings, dynamics and other accidentals written on the page. However, it is common for musicians to allow the visual and auditory aspects of practice and performance to become their top priority.

Although this may seem reasonable since a musician’s audience enjoys their craft with their eyes and ears, musicians move for a living. Violists rarely describe what they do using movement vocabulary because movement is almost always put last on their list of priorities. Movement vocabulary is instead solely reserved for talking about stage presence or repairing an injury. This is unfortunately because the physical aspects of performance, set-up, and revisions only take priority during the first one to two years of playing.

Archer’s make it a point to take age, sex, and body type into consideration when making modifications and selecting equipment. However, body type is rarely taken into consideration by viola players and pedagogues. Modifications are instead made based on age, height, and hand size. If violists begin taking age,
sex, and body type into consideration when making adjustments, they will soon realize that understanding the minor detailed differences between certain individuals can determine what issues they might be prone to and what adjustments need to be made.

Sexual dimorphism occurs in species where adult males and females exhibit phenotypic variance that extends beyond that of genitalia. Sexual dimorphism allows it to be relatively simple to distinguish male versus female without having to look to the individual’s genitalia. Both males and females exhibit additional traits specific to their sex including color, size, and body structure. While it can be difficult for humans to distinguish male from female in many animal species, sexual dimorphism is found in a variety of mammals, reptiles, fish, birds, and invertebrates. (See Figure 1 below, Female orangutan (left), male orangutan (right).

![Figure 38. Sexual dimorphism within non-human species](image)

Before reaching puberty, both male and female children have almost identical muscular and skeletal systems. However, when children reach puberty and their bodies begin to change. Archery instructors make great care in modifying a child’s setup and shooting form based on both their sexual development as well as the body type they are beginning to transition into. However, these modifications are rarely taken into consideration by viola instructors when working with young children, developing pre-teens and teens, males and females. Instead, violists and their instructors make modifications solely based on height, arm length, and hand size.

The male body naturally has more muscle mass and longer levers compared to the female body. Males also have a much broader and deeper shoulder girdle as well as a broader and deeper rib cage.

Figure 39. Male vs female chest, shoulder girdle and pelvis

205 Axford, 38.  
206 Ibid.  
207 Ibid.  
208 Ibid.  
209 Ibid, 39.
The female body is designed to accommodate pregnancy and childbirth. Females naturally exhibit a lower center of gravity and more flexibility compared to that of males. Female thighbones slope inward towards the knee and at a steeper angle. The female pelvis is much deeper and broader and tilts forward causing the back to be slightly more concave compared to the male pelvis (Axford, 38). This pelvic tilt may cause both female archers and violists to hyperextend their backs when performing at a much higher rate than males.

Figure 40. Male vs female pelvic structure

\[\text{Figure 40. Male vs female pelvic structure } 1^{213}\]

\[\text{\[210\] Axford, 38.} \]
\[\text{\[211\] Ibid.} \]
\[\text{\[212\] Ibid.} \]
\[\text{\[213\] Ibid, 133.} \]
“When standing, the weight of the torso is delivered through the lumbar core the bottom lumbar vertebrae which, together with the wings of the upper sacrum, behave as the keystone of an arch. After the weight arcs sideways through the sacroiliac joint it travels through the sturdiest, thickest part of each pelvic bone to reach its new place of balance: the widest part of our legs. The final destination of our weight is the place where our feet meet the ground.”

Figure 41. Male vs female pelvic structure

It is important that viola players, particularly female violists, learn to balance the body around the core. The natural tilt in a woman’s pelvis may tempt her to push it further forward when standing, shooting or playing an instrument. This pelvic tilt can also tempt her to also push her chest forward further exaggerating the curve in her spine.

214 Johnson, 68.
216 Johnson, 35.
Hyperextending the spine puts all the responsibility on the lower back. Hyperextending the spine can lead to chronic lower back pain and a weak core and make it difficult engage the core. This is unfortunately because many violists have mis-mapped their spines and believe that the spine is in the back.\textsuperscript{217} When using certain muscles to compensate for others, new mis-mappings begin to appear.\textsuperscript{218} Reengaging the core and remembering to find balance within front of the lumbar spine will allow the body to release unnecessary tension and rebalance. This reengagement will help violists, especially females, to engage the core and center their weight over the hip joints and rockers when sitting.\textsuperscript{219}

\textbf{Figure 42. Correct vs Incorrect Stance and Balance for Violists}

\textsuperscript{217} Johnson, 37.
\textsuperscript{218} Ibid, 33.
\textsuperscript{219} Ibid, 63.
“Because our tactile sense is so much better developed than our kinesthetic sense, and because we are able to feel only the surface portion of the spine through the flesh in the back, we have been misled into perceiving the spine as synonymous with the back. We have lost the ability to sense where the core, weight-bearing portion of the spine resides, which is down through the center.”

**Body Type**

Anyone regardless of his or her size or stature can become an advanced archer if given proper instruction. However, it is important that instructors and archers recognize these differences and modify their set up and training to better suit everyone. The Sheldon Classification System separates and groups human body types into three categories. These categories include the ectomorph, the mesomorph, and the endomorph. Ectomorphs are known for being naturally slim with very long limbs. Mesomorphs are naturally more compact and have shorter limbs. Endomorphs are typically somewhere in between and have a naturally athletic build.

“For example, high jumping favors the slim, wiry ectomorph, rugby football the muscle bulk and strength of the mesomorph and cross-channel swimming the heavier-limbed endomorph”.

Body type is rarely taken into consideration by violists and viola pedagogues. Modifications are instead made based on height and hand size. Making height and hand size synonymous with body type can have drastically negative results. An ectomorphic female and a mesomorphic male that are both 5-foot-8 inches tall cannot be given the same playing modifications.

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220 Johnson, 38.  
221 Axford, 36.  
222 Ibid, 37.
Violists of the same height may be able to play the same size instrument, but they will each have their own technical issues based on their structure. Violists of the same height may require instruments of numerous sizes and designs. A 5-foot-3 female ectomorph with large hands may be able to successfully and comfortably play a 16-inch viola, while a 5-foot-3 mesomorph or endomorph may need to select a 1’15.5-inch instrument. Luckily, custom designed violas are becoming increasingly popular to help cater to violist of all sizes and structures. However, smaller violists regardless of body type are often pressured by pedagogues into playing instruments that are much too big for them in order to produce a large sound.

**Promoting Proper Motion in the Upper Arms and Shoulder Blades**

“Windshield wipers” can done one of two ways, to help move the bow up and down using the pinky and movements within the other fingers to as common teaching tool for violists to help their students get comfortable moving from string to string. The exercise aids students with elbow rotation by showing them how high or low the right elbow needs to be when playing on specific strings. However, the windshield wiper exercise should not only be viewed as an exercise for elbow rotation. This exercise should also function in helping the student understand his or her range of motion for the upper arm and the shoulder blade.

Thinking of windshield wipers as an exercise for the upper arm and shoulders can help the student understand what that movement should feel like when executed properly. For example, if the elbow is the correct height when playing on the lowest string, but the player is raising his or her shoulder and
pushing it forward, the player is ultimately executing the movement incorrectly and causing harm to overall technique and physical wellness.

Figure 43. Range of motion for the upper arm and shoulder blade

Snow Angels

Everyone remembers making snow angels as a child. When making snow angels, a child utilizes his or her full range of motion for the upper arms and shoulder blades to imitate the motion of a bird flapping its wings.

- Stand against the wall with both feet in an open stance
- Use the full range of motion for the upper arms and shoulder blades to rock the arms up and down from where they touch the legs to where they are pointed straight up towards the ceiling
- Let the left arm drop out and continue the motion with the bow arm

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223 Axford, 25.
Figure 44. Snow Angel Motion Exercise

Chicken Dance

Children doing the chicken dance utilize the same motion when trying to imitate the flapping of a bird’s wings. However, when doing the chicken dance, the arms will only reach shoulder level as seen in Figures 43 and 45. Once violists can properly execute this motion, they can they add additional steps to the exercise.

- Stand with both feet shoulder width apart with the arms hanging at the sides
- Bend both arms at the elbow and bring both hands to the collarbone with the palms facing towards the body
- Curve the fingers until the hands are making a fist without squeezing
- Rock the arms up and down utilizing the upper arm and shoulder blade’s natural range of motion up until they reach shoulder level
- Take a pencil with the right hand and execute a proper bow hold and continue the exercise with both arms
- Take a pencil with the right hand and execute a proper bow hold and continue the exercise with both arms
- Replace the pencil with the bow and let the left hand drop out so that the motion is only being executed by the bow arm (See Figure 45).
• Let the bow arm drop out so that the motion is only being executed by the left arm
• Rotate the forearm so that the palm of the hand is facing the body
• Slightly open the arm at the elbow and continue the
Shoulder Rotations

Shoulder rotation exercises can be modified so that they can be done without a stretch band. This will allow the violist to focus solely on the movement itself rather than the resistance of the stretch band. This exercise should be done during every practice session before touching the instrument. This will help the violist reinforce proper back tension on a daily basis. This exercise can be done specifically with the right side where a violist draws the bow or simultaneously with both shoulders.

- Stand against the wall with both feet in and open stance
- Use back tension to rotate the right shoulder towards the wall until the entire shoulder is touching the wall
- Once the shoulder is touching the wall, use back tension to bring it back to starting position

Figure 47. Shoulder Rotations
• Take a pencil into the right hand and execute a proper bow hold
• Emulate set position with the arm
• Use back tension to rotate the right shoulder towards the wall until the entire shoulder is touching the wall
• Once the shoulder is touching the wall, complete motion for a down bow

Figure 48. Shoulder Rotation Modifications
Chapter 7

Conclusion

The purpose of this document is to synthesize and apply the fundamentals of archery technique and pedagogy to viola performance by prioritizing the physical aspects of playing and promoting the use of proper back tension. It is vital that violists make their physical knowledge and well-being their first priority. In doing this they will insure long-term health and success with their craft.

Aiming for the target is the last step in the draw process and will always remain the last priority on an archer’s list of things to do before releasing the arrow. 224 The shot is executed by the body and the vast majority of the shooting process is physical rather than mental. The physical aspects of the shot must take priority or else the arrow will never hit the desired target.

This hierarchy should be no different when a violist is practicing or performing, whether it be a scale or an orchestral work. Musicians work very hard to train their auditory and visual senses and for good reason.225 Musicians have a lot to focus on when practicing and performing. Musicians must focus on playing the correct notes, stage presence, producing a good tone, phrasing, bowings, dynamics and other accidentals written on the page. However, it is common for musicians to allow the visual and auditory aspects of practice and performance to become their top priority. 226

224 Axford, 76.
225 Johnson, 13.
226 Ibid.
Although this may seem reasonable since a musician’s audience enjoys their craft with their eyes and ears, musicians move for a living. 227 Viola players rarely describe what they do using movement vocabulary because movement is almost always put last on their list of priorities. It is even more rare for them to describe instrumental performance as a movement sport. Movement vocabulary is instead solely reserved for talking about stage presence or repairing an injury. 228 This is unfortunately because the physical aspects of performance only take top priority during the first one to two years of playing. 229 Many violists have unintentionally learned to put their physical wellness last on their list of priorities. This can ultimately lead to the downfall of a violist’s physical comfort and even his or her career.

The various warm-ups and strength training exercises utilized by archers will teach violists to support their physical wellness and learn to view their craft as a movement sport. Allowing violists to both see and analyze the archer’s teaching and training process will help show them the importance of utilizing proper back tension. The tension redistribution exercises listed and described will help violists reinforce their knowledge of the range of motion for the upper arms and shoulder blade. If utilized daily before even picking up the instrument, violist will be able to utilize their knowledge to achieve muscle memory lessening their chances of fatigue and injury. The muscle memory knowledge will also allow both amateur and professional viola pedagogues to create similar exercises.

227 Johnson, 10.
228 Ibid.
229 Kempter, 8.
Finally, understanding why archers revise set-up based on age, sex and body type will help viola pedagogues prevent injury within their students by helping them find proper equipment using factors beyond height and hand size.

This essay serves as a gateway for future research. It will help individual pedagogues revise their methods in a way that will make movement the foundational priority of their teaching. The essay will also act as a guide for both amateur and professional performers that should help them properly map out their daily practice in a productive way that will significantly reduce fatigue.

The essay will help both viola performers and pedagogues understand how to reengage proper back tension when setting the bow, pulling the bow, and changing strings. Pedagogues and performers can now take this useful information and apply it to very specific techniques on the viola such as vibrato, staccato, and smooth bow changes.

The proper incorporation of the elements created by this study into the daily practice routine of violists will help them develop a strong understanding of movement and coordination and give viola players a unique perspective on the importance of the physical aspects of playing. This should result in the avoidance of discomfort and injury throughout their lifetime as musicians.
Bibliography


