

Gain Without Pain: Prevention Methods for Playing-Related Injuries of Upper-Instrumentalists

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ABSTRACT

The rising popularity of people taking on an upper-string instrument, whether as a leisurely activity or a career, may allow a number of complications to emerge. Methods designed to prevent the occurrence of playing-related physical problems have been neither rigorously tested nor commonly discussed and put into practice in the upper-string instrumentalist community. Given the prevalent and seriousness of playing-related injuries of upper-string instrumentalists, this paper aims to first address the causes, types, and levels of playing-related pain and injury of upper-string instrumentalists and their literacy of and accessibility to injury and pain prevention methods. The paper provides effective practices and methods for upper-string instrumentalists injury and pain prevention.

Keywords: *upper-string instrumentalists, musicians, injury prevention, pain prevention*

1. INTRODUCTION: PROBLEM STATEMENT

Due to limited injury prevention education early on, upper-string instrumentalists are more susceptible to a variety of pains and injuries as they progress on their musical journey. These instrumentalists are often considered athletes, performing “highly repetitive movements with mean heart rate as high as 72%” [1]. Despite this, career injury incidence for symphony musicians “is reported as high as 81.3%” [1]. Upper string players have the highest prevalence of injury, and are “four times more likely to develop playing-caused lesions” compared to other instrumentalists [2]. However, many upper-string instrumentalists have limited knowledge about injury prevention before they catch serious injury or pain from playing. There are also limited occupational therapy or physical therapy programs designed for this group. This study explores the causes, types, and levels of playing-related pain and injury of upper-string instrumentalists and examines their accessibility to injury and pain prevention methods.

2. METHODOLOGY

In the paper, the author reviews literature that covers different causes, types, and levels of playing-related pain and injury of upper-string instrumentalists. A survey was conducted to investigate upper-string instrumentalist access to prevention methods (n=18) through Google

Forms and online platforms. Eighteen upper-string instrumentalists, including nine violinists and nine violists ranging from 10-25, were surveyed anonymously. With the survey findings, the author further interviewed 2 physical therapists and 3 OTs to learn about current therapeutic programs for playing-related injury and pains and the methods for individual upper-string instrumentalists to practice for injury and pain prevention.

3. PLAYING-RELATED PAIN AND INJURY OF UPPER-STRING INSTRUMENTALISTS

Through the rigorous practice and playing schedules that many instrumentalists are gradually put into throughout their high school, college, and eventually professional playing jobs, it is crucial for them to learn how to properly take care of their bodies and help prevent injury.

A table from a study by researcher HJ Fry further illustrated that violinists and violists faced the highest rates of injury and/or pain (75%) compared to cellists (73%), string bassists (60%), woodwind players (69%), brass players (39%), and percussionists (32%) [2]. Injury prevention has been widely ignored, and many have recognized this problem. The Strad author Gwendolyn Mason has noted that it continues to be a “taboo to speak freely about how unhealthy the act of violin playing really is”, and such an “assumed position required to

perform is far away from the body's natural stance", causing "[immense] strain on a player's muscles" [3].

3.1 Chronic/Overuse injury

There are many different categories of common injuries that occur in upper-string instrumentalists, one of which is overuse (chronic) injuries, often identified with muscle strain, bone fractures, strain of tendons and ligaments, and nerve pain (characterized by a tingling sensation), and are most common, making up 50% of injuries in musicians [2]. One of the biggest causes of chronic (long-term) injury is unsuitable posture, such as the position of the instrument, neck, arm or wrist, or unwanted tenseness while playing, or even holding the playing position for prolonged periods of time. The weight of the instrument may also "generate ergonomic issues related to both the static and dynamic loading exerted on the musculoskeletal system" [7]. For upper-string players especially, holding an unnatural playing position, emphasized by its "asymmetrical posture, head and neck displacement, and spinal displacement required" for playing, combined with the long hours of playing required of a professional musician, sets the basis for debilitating injury that can leave musicians unable to play for years [9].

3.2 Acute Injury

Another commonly seen injury in string and upper-string instrumentalists is acute injury. Acute injury is caused by one-time strain, mainly isotonic movements. Common causes of acute injury in this group of instrumentalists may include especially tense arm and hand vibrato movements (a tone-enhancing vibration of the left hand), intense and frequent shifting (which involves moving the left hand rapidly along the length of the neck of the instrument), sudden adjustment in posture or instrument holding position, joint strain through pizzicato (a plucking of the string using the right or left hand), and tenseness of left hand fingers when pressing down to finger notes [11]. Contrary to long-term overuse injuries are shorter-term acute injuries, caused by one-time strain. Force, repetition, and posture have been proven to be contributing factors [12]. Additionally, the "left hand/arm and shoulder were more commonly involved than the right hand/arm" and the "neck and mid-back may be affected" [12].

3.3 Common Locations of Pain and Injury

In a study of three professional orchestras, musicians "suffered from a variety of PRMDs, with a particularly high prevalence of shoulder pain (55%), lower back pain (49%), upper back pain (42%) and neck pain (39%)" [7].

3.4 Treatment for Injury

There are multiple treatment methods for musculoskeletal problems. Aside from, but also paired with rest, a common, general first approach involves the usage of "medication such as analgesics or non-steroidal anti-inflammatory drugs" additional to "ice or hot pack[s]" [13]. The average injury requires weeks to heal, and overuse injuries may take years. For many overuse injuries, total rest is needed and physical therapy and "rehabilitation may be helpful" [12]. Although procedures are costly, surgical treatment may be required in some serious injuries, and is often followed by physical therapy such as surface electromyography, which helps to "relax unnecessarily contracted muscles of the symptomatic areas" [13].

4. PRESCREEN CURRENT ASSESSMENT OF UPPER-STRING INSTRUMENTALISTS' INJURY PREVENTION ACTIVITY

Based on this information, the author developed a survey questionnaire and acquired 18 responses. From the responses, it was found that upper-string musicians entering elementary school up to middle school, often with 1-4 years of playing experience, did not have exposure to any injury and pain prevention strategies, and while around 45% of current or former high school upper-string musicians, often with more than 4 years of playing experience, did have exposure to injury and pain prevention strategies, almost all (90%) of these musicians were not exposed to injury and pain prevention strategies through their school music programs, and instead were exposed through various college, conservatory, summer program, or organization music programs.

5. METHODS FOR INJURY AND PAIN PREVENTION

5.1 Warming Up for Injury and Pain Prevention

Injury can be prevented with some simple routines with warm ups and stretching, and these warm-ups are

essential (Memphis). An author from *The Strad Magazine* emphasized the importance of stretching to counter stress on muscle fibers and tissues, which often occur “during eccentric muscle contractions, when muscles are both lengthening and contracting at the same time” [20]. University of Nevada Professor of Athletic Training Bill Holcomb (PhD) suggests to “always start with some mild aerobic warm-ups to get blood to the tissue before doing any stretching.” Athletes should never “stretch a cold muscle in any way”, and doing so may “decrease your strength, power, and performance” [21]. Current research only suggests performing vigorous stretching “when the muscles are warmed up to prevent muscle damage from a rebound effect that increases hypertonicity” [22]. Stretching is a frequently-used technique to help prevent pain and injury before and after strenuous movement [6].

5.2 Stretching for Injury and Pain Prevention

An interview was conducted with physical therapist Kalie Schwartz from Peak Sports and Spine who has worked with violinists in the past. The interview, conducted on June 2nd, 2021, aimed to collect professional information of solutions regarding the problem of injury and pain in musicians, and was performed specifically for the purpose of this research paper. When describing a previous patient who had playing-related strains due to improper care of her body during her violin playing, Schwartz especially noted that upper-string instrumentalist pain and injury was often caused by the “shrug of the shoulders” because of the “trapezius tak[ing] too much work”, which causes “muscles at the front of the chest start to shorten and the muscles in the back start to lengthen”. To prevent this, it also matters when and how you stretch, Schwartz says. Across age groups and other demographics, it is generally best to stretch “after you play” and “stretch in the

Cross arm across upper chest perpendicular to ground and pull back towards you with opposite hand, repeat with other arm, Stand facing a corner, a doorway, or with your shoulder close to a wall. Place arm on wall(s) away from you parallel to the floor at shoulder level with elbow(s) bent at 90 degrees, face away from your fingers, and lean towards the wall, Raise arms from your sides to your ears, keeping arms as far behind you as comfortable; repeat in front of you at a 45 degree angle, Circle shoulders forwards 10 seconds and backwards 10 seconds, shrugging and dropping as much as comfortable, Lace hands together and reach up as high as comfortable

morning... because you haven’t moved for a long period of time.” However, the most important thing is not frequency, Schwartz says. Instead, it’s “duration...you have to hold the stretch for a whole 30 seconds at a minimum.” For younger instrumentalists, she’d recommend a stretch of “30 seconds”, and for older [people], she recommends “45 seconds...[to] a minute.”

6. EXERCISE PROGRAM FOR INJURY AND PAIN PREVENTION

Through extensive research and contributions from professionals in the physiology field, it has been determined that many exercises can be done to prevent pain and injury caused by playing an upper-string instrument. Exercises are targeted towards the specific muscles used in playing, based on the research outlined in the “Common Locations of Pain and Injury” section of this paper.

Below is a compilation of exercises geared towards upper-string instrumentalist musicians (violinists and violists) to prevent injury and pain during and after play [20-23] [29-30]. Through extensive communication, revision and verification with multiple professional physical therapists including Colleen Bickel (PT, DPT), Kalie Schwartz (PT), and Benjamin Barnes (PT, MPT), such a program of exercises were developed for the purpose of preventing injury, and to be done ideally before, during, and after playing an upper-string instrument.

6.1 Neck and Shoulders

Move head side to side and front to back, Rotate arm at the shoulder, 10 seconds clockwise and 10 seconds counter-clockwise,

6.2 Elbows and Arms

Reach for opposite shoulder blade from behind while pushing elbow down using your other hand, alternate

6.3 Fingers and Wrists

Pull fingertips towards your body with your arm in front and palm facing outwards, alternate OR maintain a praying position and press hands down, Move wrists in a circular motion, Spread fingers out and squeeze as hard as possible

6.4 Other Upper and Lower Back or Full-Body Exercises

Thoracic spine and torso twist: lace hands together with elbows out and parallel to the floor, and twist left and right as far as comfortable, Stand with feet shoulder-width apart, lean forward and touch foot with opposite hand, Lie on ground with hands behind your head, bend knees with feet flat on the ground, tilt knees from one side of ground to the other, Kneel on ground like a cat, lower and arch back, Without bending back, maintain a planking position, Begin on all fours, then rotate one arm towards the ceiling, rotating your trunk the same way, then swing arm down and past other arm

7. CONCLUSION

Although pain and injury have been and continue to be prevalent in the upper-string instrumentalist group, methods designed to prevent the occurrence of these physical problems have been neither rigorously tested nor commonly discussed and put into practice in the upper-string instrumentalist community. Through the research presented, these problems have been addressed and solutions proposed and validated.

7.1 Exercise Outline Application: Limitations

It is important to note that the comprehensive injury and pain prevention methods may not work effectively for every individual. Additional measures not outlined in this paper should be taken into consideration when performing such exercises for injury prevention, especially pertaining to those who have special physical limitations, as evaluated by a professional.

REFERENCES

- [1] McCrary JM., BJ, et al. Acute Warm-up Effects in Submaximal Athletes: An EMG Study of Skilled Violinists. *Medicine and Science in Sports and Exercise*, U.S. National Library of Medicine, Feb. 2016, doi: <https://pubmed.ncbi.nlm.nih.gov/26312615/>.
- [2] Moraes, G. F., & Antunes, A. P. (2012). Musculoskeletal disorders in professional violinists and violists. Systematic review. *Acta ortopedica brasileira*, 20(1), 43–47. <https://doi.org/10.1590/S1413-78522012000100009>
- [3] Masin. Playing the violin places constant strain on the body, yet we leave posture to chance. *The Strad*. Retrieved 2021. Doi: <https://www.thestrad.com/debate/playing-the-violin-places-constant-strain-on-the-body-yet-we-leave-posture-to-chance/7606.article>
- [4] Mizrahi J. (2020). Neuro-mechanical aspects of playing-related mobility disorders in orchestra violinists and upper strings players: a review. *European journal of translational myology*, 30(3), 9095. <https://doi.org/10.4081/ejtm.2020.9095>
- [5] Hagberg, M., Thiringer, G., & Brandström, L. (2005). Incidence of tinnitus, impaired hearing and musculoskeletal disorders among students enrolled in academic music education--a retrospective cohort study. *International archives of occupational and environmental health*, 78(7), 575–583. <https://doi.org/10.1007/s00420-005-0621-y>
- [6] Porter, E. (2021, March 8). Isometric exercises and stretching warm-up program for University String Musicians: An Intervention Study. DigitalCommons@University of Nebraska - Lincoln. Retrieved 2021, from <https://digitalcommons.unl.edu/honorstheses/363/>
- [7] Y. Kaufman-Cohen, N. Z. Ratzon, Correlation between risk factors and musculoskeletal disorders among classical musicians, *Occupational Medicine*, Volume 61, Issue 2, March 2011, Pages 90–95, <https://doi.org/10.1093/occmed/kqq196>
- [8] Evans, B. (2019, August 27). Professionals string players describe their careers & how they found their way to the stage. *Strings Magazine*. Retrieved 2021, from <https://stringsmagazine.com/professionals-string-players-describe-their-careers-how-they-found-their-way-to-the-stage/>
- [9] Carroll, L. (2020, March 18). University of Nebraska - lincoln digitalcommons@university ... University of Nebraska. Retrieved 2021, from <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1222&context=honorstheses>
- [10] Mathias, S. (2018, August 9). Why do orchestras need sheet music and soloists don't?: Parker Symphony Orchestra. Parker Symphony Orchestra. Retrieved 2021, from

- <https://parkersymphony.org/why-do-orchestras-need-sheet-music#:~:text=Some%20professional%20orchestras%20rehearse%20as,3%2D6%2B%20pages%20each.>
- [11] Burkholder, K. R., & Brandfonbrener, A. G. (2004). Performance-related injuries among student musicians at a specialty clinic. *Medical Problems of Performing Artists*, 19(3), 116-122. Doi: <https://doi.org/10.21091/mppa.2004.3020>
- [12] Shafer-Crane, Gail. PhD, OTR, CHT. (2006). Repetitive Stress and Strain Injuries: Preventive Exercises for the Musician. *Physical Medicine and Rehabilitation Clinics of North America*. doi: <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.473.3130&rep=rep1&type=pdf>
- [13] Lee, H. S., Park, H. Y., Yoon, J. O., Kim, J. S., Chun, J. M., Aminata, I. W., Cho, W. J., & Jeon, I. H. (2013). Musicians' medicine: musculoskeletal problems in string players. *Clinics in orthopedic surgery*, 5(3), 155–160. <https://doi.org/10.4055/cios.2013.5.3.155>
- [14] Mayo Foundation for Medical Education and Research. (2020, October 20). Trigger finger. Mayo Clinic. Retrieved 2021, from <https://www.mayoclinic.org/diseases-conditions/trigger-finger/symptoms-causes/syc-20365100#:~:text=Trigger%20finger%20is%20a%20condition,o%2DVIE%2Dtis>.
- [15] Fry H. J. (1988). The treatment of overuse syndrome in musicians. Results in 175 patients. *Journal of the Royal Society of Medicine*, 81(10), 572–575.
- [16] Berque, P., & Gray, H. (n.d.). The Influence of Neck–Shoulder Pain on Trapezius Muscle Activity among Professional Violin and Viola Players: An Electromyographic Study. *Medical Problems of Performing Artists*. Retrieved 2021, from https://www.researchgate.net/publication/285766803_The_Influence_of_Neck-Shoulder_Pain_on_Trapezius_Muscle_Activity_among_Professional_Violin_and_Viola_Players_An_Electromyographic_Study
- [17] Schoonderwaldt, E., & Altenmüller, E. (2014). Coordination in fast repetitive violin-bowing patterns. *PLoS ONE*, 9(9), Article e106615. <https://doi.org/10.1371/journal.pone.0106615>
- [18] Bejjani, Fadi Joseph. New York University. ProQuest Dissertations Publishing, 1987. 8803576. Doi: <https://www.proquest.com/openview/5300689be66cd1eea4157b5a26ea149/1?pq-origsite=gscholar&cbl=18750&diss=y>
- [19] Potter, P. J., & Jones, I. C. (1995). Medical problems affecting musicians. *Canadian family physician Medecin de famille canadien*, 41, 2121–2128.
- [20] Black, J. (2020, February 25). 11 stretching exercises for musicians. *The Strad*. Retrieved 2021, from <https://www.thestrad.com/playing-and-teaching/11-stretching-exercises-for-musicians/27.article>
- [21] Bain, J. (2010, October 25). Proper stretching techniques: Warming up, dynamic stretches, and more. WebMD. Retrieved 2021, from <https://www.webmd.com/fitness-exercise/features/new-ideas-on-proper-stretching-techniques>
- [22] How to stretch. *Stretching and Flexibility - How to Stretch*. (n.d.). Retrieved 2021.
- [23] Kormos, M. The ideal stretching routine. *Harvard Health*. (2021, February 3). Retrieved 2021, from <https://www.health.harvard.edu/staying-healthy/the-ideal-stretching-routine>
- [24] Bramble, L. (2021, April 19). Static vs. dynamic stretching: What are they and which should you do? *Hospital for Special Surgery*. Retrieved 2021, from https://www.hss.edu/article_static_dynamic_stretching.asp#:~:text=Static%20stretches%20are%20those%20in,tissues%20for%20performance%20and%20safety
- [25] Kendall B. J. (2017). The Acute Effects of Static Stretching Compared to Dynamic Stretching with and without an Active Warm up on Anaerobic Performance. *International journal of exercise science*, 10(1), 53–61.
- [26] Simic, L., Sarabon, N., & Markovic, G. (2013). Does pre-exercise static stretching inhibit maximal muscular performance? A meta-analytical review. *Scandinavian journal of medicine &*

science in sports, 23(2), 131–148.
<https://doi.org/10.1111/j.1600-0838.2012.01444.x>

- [27] Gavin, M. L. (Ed.). (2019, January). Overuse injuries (for teens) - nemours kidshealth. KidsHealth. Retrieved 2021, from [https://kidshealth.org/en/teens/rsi.html#:~:text=The%20growth%20spurt%20\(the%20rapid,teens%20more%20prone%20to%20injury](https://kidshealth.org/en/teens/rsi.html#:~:text=The%20growth%20spurt%20(the%20rapid,teens%20more%20prone%20to%20injury)
- [28] Schwartz. (n.d.). Rethinking your warm up. Retrieved 2021, from https://wpmedia.smartmusic.com/wp-content/uploads/2021/01/100118_SM_WarmUps_ebook.pdf
- [29] 11 stretching exercises for musicians. The Strad. (2020, February 25). Retrieved 2021, from <https://www.thestrads.com/playing-and-teaching/11-stretching-exercises-for-musicians/27.article>
- [30] *The ideal stretching routine*. Harvard Health. (2021, February 3). Retrieved from <https://www.health.harvard.edu/staying-healthy/the-ideal-stretching-routine>