

A MUSICIAN'S GUIDE TO FOCAL DYSTONIA:  
DEVASTATION AND REHABILITATION

by

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*To musicians suffering from focal dystonia*



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# INTRODUCTION

Seven years have passed since I first suffered from focal dystonia, which came upon me without any warning. Suddenly I was overwhelmed with questions and doubt. How could I have prevented this? What have I done wrong? Why am I the only one being punished? Like so many others, I had been determined to perfect my musical and technical abilities. I was consumed with doubts, self-reproach, and resentment, anything I could use to accuse myself for letting this happen. Like so many musicians before me, I had to learn that my only hope was to face my problem with patience and optimism. From that realization was born this project. Once I put my mind and heart into research and recovery, I discovered my power to help others. I am sharing all of my knowledge of focal dystonia here, to guide those who are experiencing the doubts that I once felt.

Over the past seven years, I have learned how to alleviate the dystonic symptoms, and have returned to performing with my affected finger. During my journey towards recovery, I discovered the delicate complexities of this condition, which is a strange amalgamation of physical, neurological, and psychological issues. Focal dystonia is difficult to understand, and formidable to treat. Therefore, the main focus of this project will be to guide musicians on how to practically cope with the condition in both physical and psychological ways. This paper, on musician's dystonia, will be most relevant for string instrumentalists experiencing focal dystonia of the hands.<sup>1</sup>

Focal dystonia (hereafter abbreviated as FD) is a neurological, performance-related long-term injury. Musicians can acquire this condition through physical or psychological stress, such as from intense professional environments, excessive technical practice, the demands of mastering an instrument,<sup>2</sup>

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<sup>1</sup> Readers may find it referred to by different names: musician's cramp, musician's hand dystonia, or task-specific dystonia.

<sup>2</sup> Florence C. F. Chang and Steven J. Frucht, "Motor and Sensory Dysfunction in Musician's Dystonia," *Current Neuropsychology* 11, no. 1 (January 2013): 41.

and physically strenuous working conditions. Although the study of neurological injuries has been considerable, only recently have researchers begun to shed light on the causes of FD.

FD is a malfunction in how the brain controls a particular muscle area. This disruption manifests itself as a loss of fine motor control in a very worked part of the body (essential for playing the instrument). Additionally, this condition includes involuntary movements (dystonic symptoms) such as trembling, collapsing joints, awkward posture, and spasms in the affected area. As musicians are deprived of the dexterity and control they had gradually acquired through years of practice, many lose the ability to play entirely. A case of FD can completely destroy a musician's career.<sup>3</sup>

This condition is diagnosed fairly often among musicians. According to the *Dystonia UK*, "approximately 1-2% of all professional musicians are affected by FD."<sup>4</sup> Furthermore, a study published in 2018 indicates that the prevalence rates for professional musicians with FD are not negligible, and rest between 0.5 and 8%.<sup>5</sup>

Many people suffer from different types of FD, such as cervical dystonia, blepharospasm dystonia, laryngeal dystonia, embouchure dystonia, or musician's or writer's cramp. The onset of these conditions usually appears between the ages of sixteen and seventy-five, with the average age of onset ranging between thirty and forty.<sup>6</sup> These numbers, however, depend on certain factors, such as field of work, hours of labor, or gender.

Even though FD is normally a painless disorder,<sup>7</sup> patients may develop secondary pain from trying to suppress or circumvent involuntary movements and dystonic symptoms. According to FD

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<sup>3</sup> Hans-Christian Jabusch and Eckart Altenmüller, "Anxiety as an Aggravating Factor during Onset of Focal Dystonia in Musicians," *Medical Problems of Performing Artists* 19, no. 2 (June 2004): 75.

<sup>4</sup> "Hand Dystonia," *Dystonia UK*, accessed July 9, 2020, <https://www.dystonia.org.uk/Pages/FAQs/Category/hand-dystonia>.

<sup>5</sup> Takashi Asahi, Takoma Taira, Kiyonobu Ikeda, Jiro Yamamoto, and Shuji Sato, "Full Recovery from Drummer's Dystonia with Foot and Arm Symptoms after Stereotactic Ventro-oral Thalamotomy: A Case Study," *Acta Neurochirurgica* 160, (2018): 835.

<sup>6</sup> Chang and Furcht, "Motor and Sensory Dysfunction in Musician's Dystonia," 41.

<sup>7</sup> Jabusch and Altenmüller, "Anxiety as an Aggravating Factor during Onset of Focal Dystonia in Musicians," 75.



experts Hans-Christian Jabusch and Eckart Altenmüller,<sup>8</sup> pain plays a role both in the development and the mitigation of musicians' dystonia. Jabusch and Altenmüller explain, "Pain syndromes may serve as triggers for the development of dystonia and pain may also occur as a consequence of the persistent attempts by patients to correct the involuntary movements and postures."<sup>9</sup>

FD in musicians is classified as a task-specific dystonia, because musicians experience its symptoms only while playing their instruments— or, in other words, while executing a particular task.<sup>10</sup> Therefore, most musicians with FD will not experience symptoms in other daily activities, even if they engage the same muscle area. For example, actions such as brushing one's teeth, holding a cup, or chewing gum may involve muscles affected by dystonic symptoms—e.g. focal hand dystonia for string players, or embouchure dystonia for wind players—but those same muscles may remain unaffected when utilized for non-musical tasks.<sup>11</sup>

Because there is no definitive cause of this disease<sup>12</sup>, the present understanding of the origins of FD is mostly circumstantial. For example, studies have found a co-incidence of FD with repetitive task-specific movements, overuse of particular muscles, sudden changes of technique, and insufficient resting time during practice. In addition, there has been a correlation with strenuous psychological states, such as negative reinforcement, increased perfectionism, high stress, trauma, and anxiety.<sup>13</sup> However, none of these can be considered a true cause of the condition, since the vast majority of musicians experience these factors without developing FD. Why only some musicians develop FD continues to inspire much research. I will present the current research in Chapter 1: Research on FD, to inform the reader about its symptoms, influential factors, diagnosis, classification, and statistics.

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<sup>8</sup> Musicians' medicine specialists and neurology researchers specialized in FD. Their work will be explored further in chapters 1 and 2.

<sup>9</sup> Hans-Christian Jabusch and Eckart Altenmüller, "Focal Dystonia in Musicians: From Phenomenology to Therapy," *Advances in Cognitive Psychology* 2, no. 2 (January 2006): 212.

<sup>10</sup> *Ibid.*, 207.

<sup>11</sup> *Ibid.*, 210.

<sup>12</sup> *Ibid.*, 207.

<sup>13</sup> Chang and Furcht, "Motor and Sensory Dysfunction in Musician's Dystonia," 42.

Since the causes of FD remain indeterminate, experts have yet to discover one fully effective cure.<sup>14</sup> Fortunately, a recent growth in research has led to an increase in FD treatment options, which have allowed affected musicians to have fulfilling careers. In Chapter 2: Treatments, readers can explore the various methods of treatment and therapy. Some solutions are in the pharmaceutical realm, and involve chemical treatment, while others aim to retrain the body and brain through physical exercises and techniques. Certain treatment methods are more or less useful depending on the severity of symptoms. I will include specific information to clarify the practicality of each method.

The initial symptoms of FD can be difficult to recognize. Some patients instinctively try to adapt their movements to avoid the sensations, but this can exacerbate the situation. As with many neurological conditions, the symptoms and suitable treatments differ depending on the case; FD may progress over time, or may remain constant from the onset. The period of time over which the condition worsens also varies among patients, as does the duration of treatment and retraining. I will discuss all of the unique characteristics of FD in relation to my own case in Chapter 3: Personal Experience and Approach, which focuses on my experiences with the condition.

Despite the difficulties of FD, there are some cases in which musicians, including myself, have been able to manage their symptoms and maintain their professional careers. Maintenance and management of symptoms is, however, not the same as a cure. In Chapter 4: Case Studies, the reader can explore the unique ways in which certain musicians have learned to manage their conditions. These patients may not be fully cured, but instead have developed successful coping strategies that have allowed them to continue in their professions.

Although there is no existing cure for FD, there are many techniques and exercises that musicians can use to offset or mitigate symptoms. I have included several of these physical exercises in the

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<sup>14</sup> Jabusch and Altenmüller, “Anxiety as an Aggravating Factor during Onset of Focal Dystonia in Musicians,” 75.

appendix. These exercises have proven very useful for musicians with the condition. Many of them come from doctors and specialists, via musicians who went through a retraining process.

In this project, I will demonstrate the importance of guidance and professional input while dealing with FD, from a musician's point of view. I am not attempting to offer a solution to the condition. Rather, I will examine how it has been possible for some musicians to continue in their chosen career. My journey and research on FD are ongoing, but I hope that this project will be a relevant and informative guide for many musicians who are suffering from FD.

## CHAPTER 1: THE RESEARCH ON FOCAL DYSTONIA

In comparison to other occupational conditions, such as carpal tunnel syndrome and tendonitis, Focal Dystonia is an under-discussed condition among musicians; however, it affects a greater percentage of musicians than one might imagine. It is generally known that, like carpal tunnel and tendonitis, FD is induced by repetitive tasks and muscle fatigue. Causes beyond these (e.g., anxiety or poor technique) are more subjective, and therefore more difficult to identify. Despite the uncertainty surrounding the etiology<sup>1</sup> and pathophysiology<sup>2</sup> of FD, a recent surge of treatment methods has stemmed from progress in the research of neurologic injuries in performing artists.

In this chapter, I will examine FD in depth by analyzing its symptoms, influential factors, diagnoses, and statistically affected groups. I aim to elucidate the public on the ways that this condition affects career musicians, and to present the currently available treatment options.

My principal source of information in this chapter is a study that documents FD in musicians; this study was conducted by Dr. Hans-Christian Jabusch and Dr. Eckart Altenmüller at the University of Music and Drama, Institute of Music Physiology and Musician's Medicine in Hannover, Germany in 2005. One hundred forty-four German professional musicians and students with FD participated in the survey, which has become the preeminent body of research on FD.<sup>3</sup> It is important to note, as the authors acknowledged, that the data from this study may be faulty due to inherent limitations.<sup>4</sup> The study involved a demanding and time-intensive rehabilitation process, which led many subjects to discontinue their involvement. Other subjects left the study after not experiencing significant results, feeling that they were

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<sup>1</sup> Causation of disease or condition.

<sup>2</sup> A study of physical functions caused by a disease or an abnormal syndrome.

<sup>3</sup> Hans-Christian Jabusch, Dorothea Zschucke, Alexander Schmidt, Stephan Schuele, and Eckart Altenmüller, "Focal Dystonia in Musicians: Treatment Strategies and Long-Term Outcome in 144 Patients," *Movement Disorders*, 20, no. 12 (December 2005): 1623–26.

<sup>4</sup> *Ibid.*, 1626.

not spending their time productively.<sup>5</sup> Because the study lacked a proper distribution and consistency of subjects, the researchers' ability to confirm the benefits of specific approaches was limited. Nonetheless, this study provides valuable information for those suffering from FD. Musicians will continue to struggle with this condition, but as we understand its nature more closely, we increase the chances of recovery.

## **A. Symptoms**

As discussed in the Introduction, the most common symptoms of FD in musicians manifest themselves as specific involuntary motions, such as trembling, spasms, contractions, and abnormal postures. These symptoms vary in degree, from mild cases that can be alleviated with physical therapy or pharmacological treatment, to severe cases that can hinder the patients' holding an instrument. In the more severe cases, physical therapy alone may not be sufficient to salvage a musician's career.

The musicians who contract FD in the hands (specifically pianists, string players, and guitarists), often experience the affected fingers involuntarily curling inwards (a type of spasm) as shown in Figure 1 below. This curling indicates that the hand's flexion is disproportionately stronger than the contrary movement, the extension. In some cases, the extensor is over developed, and the fingers will extend away from the palm. When extension does occur, the fingers resist returning back to a normal position. Trembling may appear at the time of the onset; however, in some cases, it disappears quickly as the FD progresses. An abnormal posture is usually the result of compensating for these two involuntary movements—spasms and trembling.

Musicians can display FD symptoms in either hand, regardless of dominant handedness. Additionally, the symptoms can develop in relation to any type of workload; for example,<sup>6</sup> one might expect that FD would only manifest itself in the left hand for string players, but in fact, it can also develop in the bow hand (right).<sup>7</sup>

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<sup>5</sup> Jabusch and Altenmüller, "Focal Dystonia in Musicians: From Phenomenology to Therapy," 217.

<sup>6</sup> Jabusch and Altenmüller, "Focal Dystonia in Musicians: From Phenomenology to Therapy," 211.

<sup>7</sup> Farias, Joaquin. *Intertwined. How to Induce Neuroplasticity: A new approach rehabilitating dystonias*. (Garlene Editions, 2012), 33. Kindle.



**Figure 1. Typical patterns of dystonic posture in a pianist and a violinist.<sup>8</sup>**

Similar to FD in the hands, embouchure<sup>9</sup> dystonia commonly causes wind and brass players to lose control of the muscles relating to the face and mouth. Embouchure dystonia is also regarded as a task-specific dystonia, and its common involuntary movements include the following symptoms: trembling muscles around the mouth, involuntary puckering, and difficulties in changing registers and blowing air through the instrument's mouthpiece. There are also some cases in which wind and brass players also develop FD in other parts of the body, such as their hands, if that part of the body is under particular stress.<sup>10</sup>

Furthermore, FD can affect singers in the larynx, a hollow muscular organ that creates resonance from airflow. Those with laryngeal dystonia lose control of these muscles and experience spasms. This condition results in issues with transitioning between registers, controlling pitch, or maintaining the sound while singing. Singers with laryngeal dystonia may even find it difficult to speak, and have a whispery or strangled voice.

The pace at which dystonic symptoms develop varies case by case. Most cases will develop over some months, but there have been documented instances where an individual develops FD in just a few

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<sup>8</sup> Eckart Altenmüller and Hans-Christian Jabusch, "Focal dystonia in musicians: phenomenology, pathophysiology, triggering factors, and treatment," *Medical Problems of Performing Artists* (March 2010): 4.

<sup>9</sup> A technique using certain muscles around the lips and jaw on the mouthpiece of wind and brass instruments.

<sup>10</sup> Altenmüller and Jabusch, "Focal Dystonia in Musicians: Phenomenology, Pathophysiology, Triggering Factors, and Treatment," 4; and Jabusch and Altenmüller, "Focal Dystonia in Musicians: From Phenomenology to Therapy," 211.

days.<sup>11</sup> There is, however, no precise data in Jabusch and Altenmüller’s research regarding the rate at which symptoms can progress. From the earliest stages of FD, it is important to observe how the symptoms evolve, and to make appropriate decisions in response. Patients often react to the initial physical disruption by practicing their instruments more intensively, with the hope of restoring normal function to the affected area; however, this response can aggravate the symptoms. Mis-handling the early signs may push patients into a phase where they begin to experience mild tremors, which in turn tempts the musician to forcibly control their movements. This vicious cycle leads to worsened symptoms, like tension, spasms, and involuntary motion. Once the involuntary movements or spasms appear, the patients may not be able to recover the function of the affected appendage.

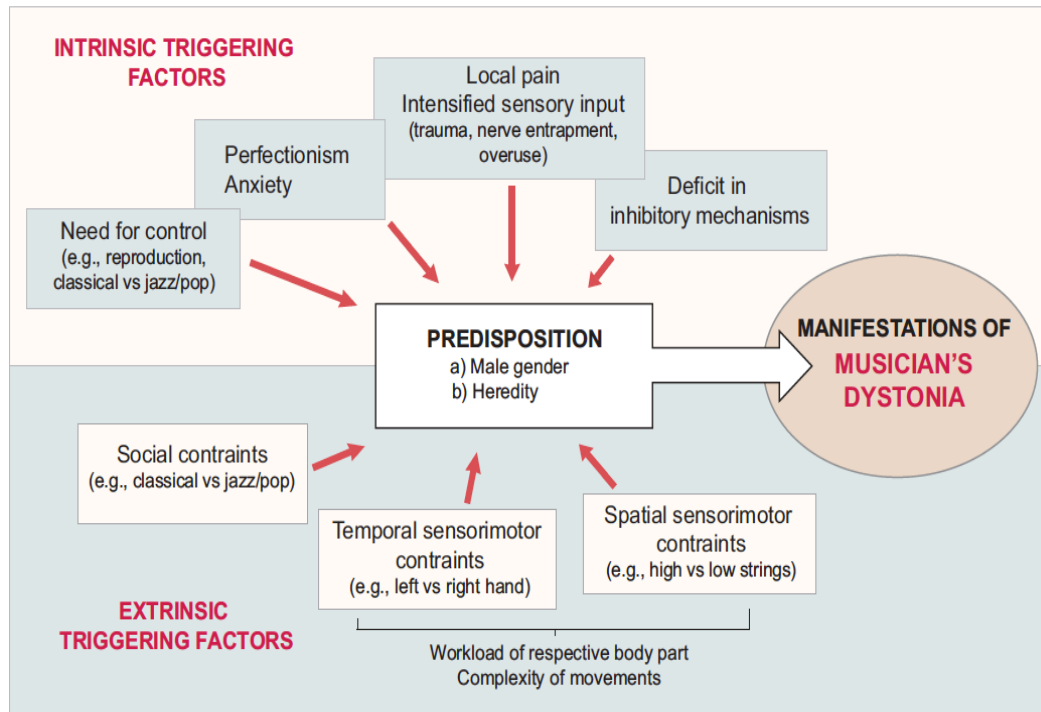
## **B. Influential factors**

Even with the constant developments in medical science and technology, the neural pathways that connect the brain with muscle tissue remain mysterious, and therefore the causes of this condition elude the experts. However, according to “Focal dystonia in musicians: phenomenology, pathophysiology, triggering factors, and treatment”, musicians with FD share a few common tendencies that appear to be triggering factors. The chart below broadly categorizes these common traits:

- Influence of genes or family history—(Predisposition)
- Muscular fatigue: (Extrinsic triggering factors)
  - Overuse and repetitive movement of a particular muscle
  - Insufficient rest or sudden increase of hours in practice after a long break
- Sudden changes in performance: technique, instrument, posture
- Varied psychological elements: perfectionism, stress, trauma, and anxiety— (Intrinsic triggering factors)

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<sup>11</sup> Farias, *Intertwined*, 20.



**Figure 2. The possible interplay between predisposition and intrinsic and extrinsic triggering factors in the manifestation of musician's dystonia.<sup>12</sup>**

### B-1. Predisposition

Family history is a significant risk factor. In one study by Jabusch and Altenmüller, they considered a family to have a positive history if more than one family member was affected by dystonia within three generations. Of twenty-eight families used in their study, eighteen (or sixty-four percent) had a positive history.<sup>13</sup> The dystonic gene has a high probability of being inherited, as explained on the website of “The Dystonia Society”:

Some types of dystonia have been linked to a gene that can be inherited. Dystonia that develops during childhood without an environmental cause is often inherited through one or more affected genes. Most genetic dystonia is inherited in a dominant manner, meaning that, if a parent has this type of dystonia, there is a 50% chance of passing the dystonia gene to each child.<sup>14</sup>

<sup>12</sup> Altenmüller and Jabusch, “Focal Dystonia in Musicians: Phenomenology, Pathophysiology, Triggering Factors, and Treatment,” 7.

<sup>13</sup> Ibid., 4.

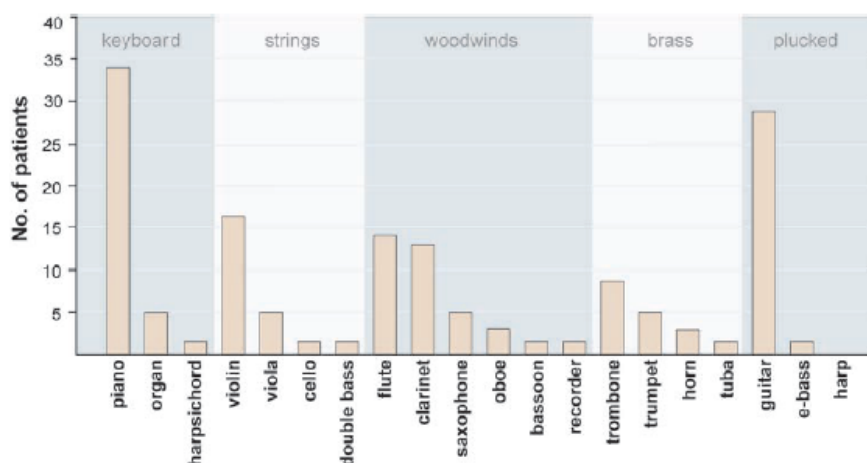
<sup>14</sup> “Dystonia Explained,” The Dystonia Society, accessed October 13, 2020, <https://www.dystonia.org.uk/Handlers/Download.ashx?IDMF=ab5aa3a8-d0e3-46e4-a8fa-e230dba34689>.



## B-2. Extrinsic factors

The overuse and repetition of extremely precise fine motor skills are likely triggers of FD. A number of scientific studies reveal the hazardous nature of these movements. A study conducted in Germany emphasized the demands in precision of the higher stringed instruments:

Within the string family, musicians who were playing the high string instruments (violin, viola) were more often affected compared to those with low string instruments (cello, double bass). The observed occurrence in high string players was significantly higher than expected according to the overall distribution of high and low string players in German orchestra musicians. The demands on spatial sensorimotor precision required for violin and viola playing are higher than for the low string instruments. Thus, primarily musicians with those instruments requiring highest spatial sensorimotor precision were affected by dystonia (Figure 3 below).



**Figure 3. Distribution of instruments in 144 patients with musician's dystonia<sup>15</sup>**

This survey, conducted by Jabusch and Altenmüller, seems to suggest that musicians from certain instrument groups are at higher risk of developing FD (pianists, guitarists, violinists, and wind/brass players), although this survey was limited by an inconsistent sample size.<sup>16</sup>

The required sensorimotor precision can lead musicians to spend more practice time on repetition. Additionally, if their resting time is insufficient, they increase the risk of developing FD. Often, musicians

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<sup>15</sup> Altenmüller and Jabusch, "Focal Dystonia in Musicians: Phenomenology, Pathophysiology, Triggering Factors, and Treatment," 5.

<sup>16</sup> Jabusch et al., "Focal Dystonia in Musicians: Treatment Strategies and Long-Term Outcome in 144 Patients," 1626.

will not feel the effects of unhealthy practices until their mid-thirties. At a younger age, muscle deterioration is imperceptible, and the pace of muscle recovery is quicker than at a more advanced age. A musician's career typically is at its peak between ages thirty and forty, and musicians may have less time to rest as a consequence. Therefore, it is not surprising that research places the average age of onset in the mid-thirties, although the range extends from eighteen to sixty-years, based on the survey conducted by Jabusch and Altenmüller.<sup>17</sup>

Other factors include problems in technique or sudden physical adjustments. For example, changing instruments or technical set-up, or playing with an ill-aligned instrument, may affect a musician's likelihood to contract FD. One case from Farias' book *Intertwined* revealed a situation where a violinist suffered from FD in his bow arm (right), and had to terminate his career. He then sold the bow to someone else, who in turn developed the same rare type of FD. This story does not mention what ill-alignment was present in this bow, but both musicians had to quit playing the violin because of it.<sup>18</sup> Because no two instruments have exactly the same proportions, this particular bow might have required the musicians to alter their bow technique in a damaging way. Indeed, Farias suggests this possibility, saying "Changes of technique modify the automatized motor programs formed earlier in childhood, causing dysfunctional associations between execution and excessive muscular tension."<sup>19</sup> This sudden technique change may have triggered FD in them.

### **II-c. Intrinsic factors**

Of the psychological risk factors, perfectionism is particularly interesting to examine. A paradox of developing highly virtuosic technique, which should give an artist great confidence, is that anxiety drives the need to accomplish. Perfectionism often prevents musicians from being satisfied with their work. In a survey of musicians with FD, perfectionism was one of the most common personality traits among the musicians.

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<sup>17</sup> Altenmüller and Jabusch, "Focal Dystonia in Musicians: Phenomenology, Pathophysiology, Triggering Factors, and Treatment," 4.

<sup>18</sup> Farias, *Intertwined*, 33.

<sup>19</sup> *Ibid.*, 35.

In a study, the dynamics of different anxiety disorders in musicians with FD were investigated; musicians with FD showed more traits of perfectionism and anxiety compared to healthy musicians. The participants with FD also reported that those psychological conditions were present before onset of FD. From the analysis, musicians with FD experienced social phobia remarkably more than healthy musicians, which already had been the case before they developed FD. The question arises whether the described psychological patterns with anxiety and exaggerated perfectionism might have an impact on the development of FD in musicians. During onset of musician's FD, dystonic movements are realized as disturbing and threatening, especially by musicians with an inclination toward anxiety and extreme perfectionism. Dystonic movements might become a focus in terms of a specific phobia in musicians with these tendencies. In such patients, early intervention during onset of FD including management of these particular psychological patterns, might be beneficial.<sup>20</sup>

Musicians have pushed themselves to meet ever-higher standards of masterful performance, and seek to give audiences the rush of adrenaline from hearing brilliant, virtuosic pieces. The social pressure to satisfy audiences, themselves, and other musicians pushes performers spend hours of practice mastering technical passages. Ironically, the increase in the amount of workload can cause an increase in psychological strain, and even induce new psychological conditions, as different surveys observed:

... epidemiological findings indicate that the amount of workload of the respective body part, the complexity of movements and the degree of spatial and temporal sensorimotor precision as well as the level of social constraints associated with the musical performance were related to musician's dystonia.<sup>21</sup>

At the same time, many studies focused on psychiatric comorbidity<sup>22</sup> in patients with various forms of dystonia. Depressive, anankastic, sensitive, and hysteric traits were observed in patients with writer's cramp. Anxiety occasionally was seen in patients with writer's cramp. It was discussed controversially whether psychological findings were present before onset of dystonia or whether patients showed a secondary psychoreactive process.<sup>23</sup>

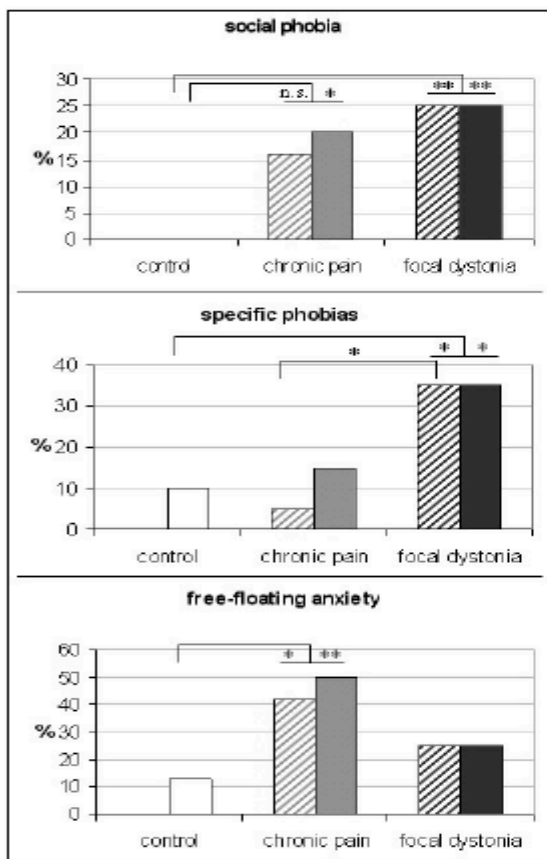
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<sup>20</sup> Jabusch and Altenmüller, "Anxiety as an Aggravating Factor during Onset of Focal Dystonia in Musicians," 75.

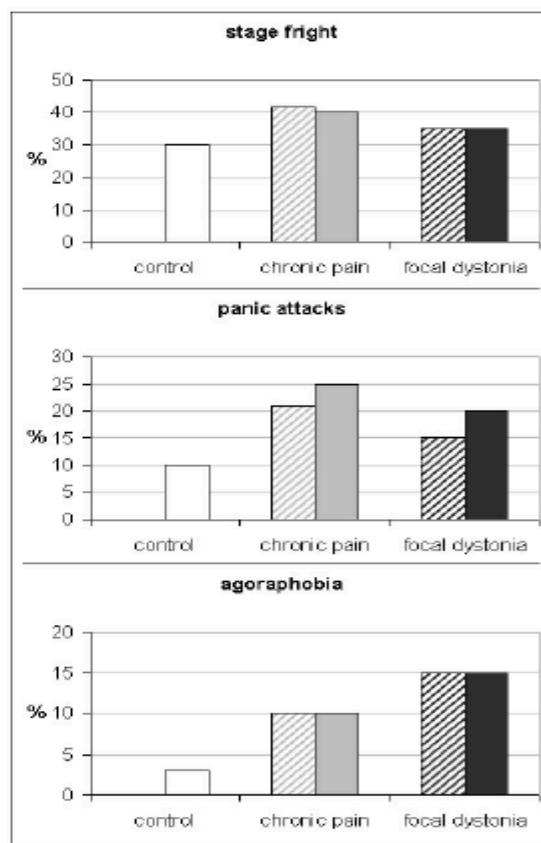
<sup>21</sup> Jabusch and Altenmüller, "Focal Dystonia in Musicians: From Phenomenology to Therapy," 211.

<sup>22</sup> Two different types of disease affect a patient at the same time.

<sup>23</sup> Jabusch and Altenmüller, "Anxiety as an Aggravating Factor during Onset of Focal Dystonia in Musicians," 75.



**FIGURE 1.** Anxiety disorders in controls and musicians with chronic pain and with focal dystonia. Percentage of subjects (of respective groups) who reported social phobia, specific phobias, and free-floating anxiety. Hatched bars: percentage with anxiety before onset of the respective playing-related problem. Filled bars: percentage with anxiety after onset of the respective playing-related problem. \* $p < 0.05$ . \*\* $p < 0.01$ . n.s., not significant.



**FIGURE 2.** Anxiety disorders in controls and musicians with chronic pain and with focal dystonia. Percentage of subjects (of respective groups) who reported considerable stage fright, panic attacks, and agoraphobia. Hatched bars: percentage with anxiety before onset of the respective playing-related problem. Filled bars: percentage with anxiety after onset of the respective playing-related problem.

**Figure 4. The percentages of musicians with psychological conditions, distributed over those without injury, those with chronic pain, and those with FD. Hatched bars indicate before the onset of the injuries, and grey or black colored bars display after the onset.<sup>24</sup>**

The purpose of the above survey, from a study by Jabusch and Altenmüller, is to find common anxiety disorders among musicians with FD. The disorders were categorized as severe stage fright, panic attacks, free-floating anxiety, agoraphobia, social phobia, and more specific phobias. Also, a questionnaire was used to assess patients' responses, as shown below.

<sup>24</sup> Jabusch and Altenmüller, "Anxiety as an Aggravating Factor during Onset of Focal Dystonia in Musicians," 77.

### Questionnaire

Please answer the following questions by checking the appropriate box. If you answer yes to any of the questions, please try to specify since when you have experienced the respective fears or anxieties by using the following terms:

- always
- long before the onset of the movement disorder\*
- after the onset of the movement disorder\*
- not any more

|  | No | Yes | Since When? |
|--|----|-----|-------------|
| Are you suffering from acute (considerable) stage fright?  |    |     |             |
| Have you ever have experienced anxiety attacks (i.e., were you suddenly and unexpectedly overcome by strong fear or apprehension in a situation normally considered nonthreatening)?                                       |    |     |             |
| Have you ever felt anxious, tense, or worried for a prolonged period ( $\geq 6$ months)?<br>Did or do you often worry about events that are unlikely to occur?   |    |     |             |
| Some people are afraid of going out alone; encountering crowds of people; or traveling by car, bus, or train. Have you ever experienced such a fear?   |    |     |             |
| Some people are afraid to be, speak, or work in the presence of others, so they avoid those situations or endure them only with great discomfort. Have you ever had anxious feelings of that kind?                         |    |     |             |
| In certain situations, some people experience intense anxiety (e.g., fear of heights, fear of flying, fear of enclosed spaces), so they try to avoid those circumstances. Have you ever had anxious feelings of that kind? |    |     |             |

\*In the questionnaires for patients with chronic pain syndromes, *movement disorder* was replaced by *pain*.

This is an English translation of the questionnaire that was designed to assess anxiety disorders. The original questions were written in German.

**Figure 5. Questionnaire for the assessment of various psychological disorders<sup>25</sup>**

The anxiety about failure, the obsessive repetition of technically demanding passages, the tendency towards intense performance preparation with little rest, and the overuse of certain muscle groups will impact performers in many different ways. However, the extrinsic and intrinsic factors, combined with a genetic predisposition, appear to be the most likely cause of FD.

<sup>25</sup> Jabusch and Altenmüller, "Anxiety as an Aggravating Factor during Onset of Focal Dystonia in Musicians," 81.

## C. Diagnosis

There are several ways to diagnose patients with FD. The diagnosis process begins with questions about the patient's medical and family history, followed by a physical examination. The questions may cover the following topics:

- Life events
- Family history of Parkinson's disease<sup>26</sup>
- Onset of symptoms
- Manifestation and progress of focal dystonia symptoms
- Medical history

During the physical examination, the doctor tests the patient's reflexes, strength, and flexibility. It may be helpful for the patient to bring an instrument to the appointment, so that the doctor can observe how the symptoms manifest themselves. After the physical examination, a neurologist may order an electromyography test (EMG), electroencephalography (EEG), or a nerve conduction study, in which a device for the test will be attached to several muscles around the affected area to examine the transmission of the nerve signals, either with the instrument or without. The EMG test identifies muscles that are affected and weakened. The test may show a lack of control or responsiveness in the affected muscle area, compared to other muscle areas. Some other ways to diagnose FD include laboratory studies with blood and urine tests, analyses of cerebrospinal fluid (a clear fluid found in the central nervous system), and genetic testing, but these are rarely used for musicians' dystonia. If the doctors are specialized in consulting musicians with FD, they may be able to recognize the symptoms and diagnose affected areas solely through a physical screening.

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<sup>26</sup>As explained by the Dystonia Medical Research Foundation of Canada, "in the Parkinsonian disorder known as Parkinson's disease, certain features of the disease can be thought of as a form of dystonia." For more information see, "What is the difference between a Parkinson's disease patient with dystonia and a dystonia patient with Parkinson's symptoms?," Dystonia Medical Research Foundation Canada, accessed October 14, 2020, <https://dystoniacanada.org/what-difference-between-parkinson-s-disease-patient-with-dystonia-and-dystonia-patient-with-parkinson-s-symptoms>.

#### **D. Classification and Statistics**

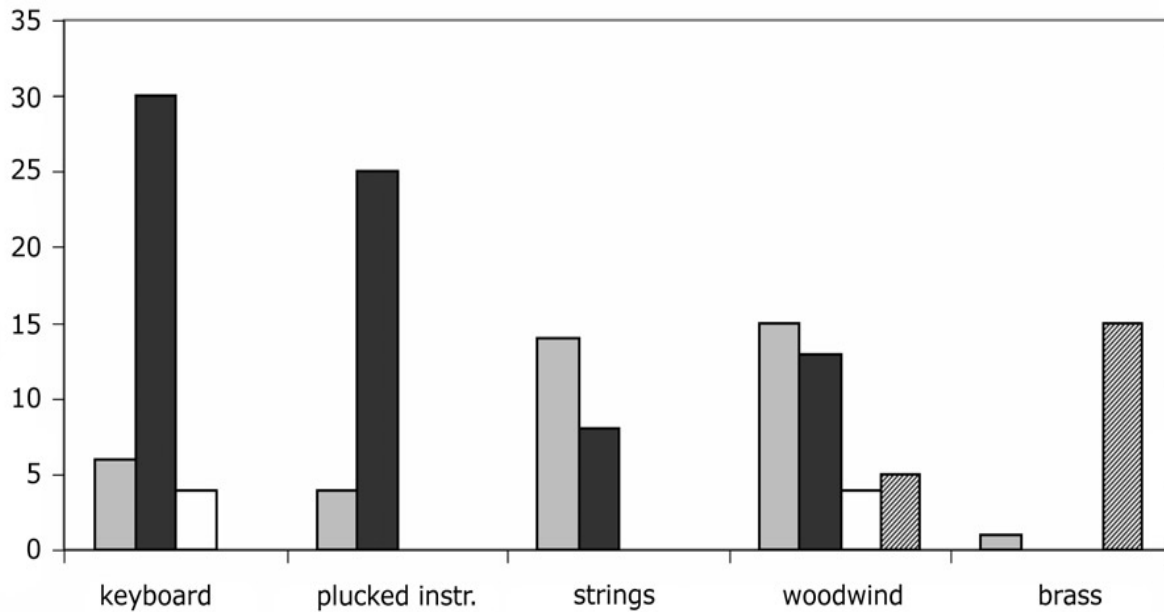
Because the origins of FD in musicians are unknown, the question remains why the condition affects certain instrument groups more than others. The survey “Focal Dystonia in Musicians: From Phenomenology to Therapy” conducted by Jabusch and Altenmüller provides various statistics on the prevalence of FD among different instrumentalists, as well as their affected muscles, age range at onset, profession, gender, and so on. One hundred forty-four professional musicians with FD participated in this study, with the distribution of participants as follows: “15% of patients were bowed string players, 28% were keyboard instrumentalists, 20% were playing plucked instruments, 26% were woodwind players and 11% were brass players.”<sup>27</sup>

As Figure 6 below shows, each instrument has specific characteristics which affect the location and type of FD. Keyboard players (piano, organ, harpsichord) and plucked instrument players (guitar, electric bass, no harp) most commonly have FD in the right hand (represented by the black colored bars), while string players have it in the left hand (grey bars), and wind and brass players develop it in the jaw and lips (hatched bars) or in one or both hands. For the respective instruments, these parts of the body usually have a higher workload, and perform precise, sensorimotor tasks.

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<sup>27</sup> Jabusch and Altenmüller, “Focal Dystonia in Musicians: From Phenomenology to Therapy,” 208.

No. of patients



**Figure 6. The prevalence of FD different locations in the body of musicians, based on the instrument group: a grey bar indicates left hand, black bar right hand, white bar both hands, and hatched bar embouchure.<sup>28</sup>**

As mentioned earlier, FD can affect musicians at all ages, but it most often appears when these musicians are in their thirties. The patients in the study ranged from seventeen to sixty-three years, with the average age of onset at thirty-three years.<sup>29</sup> This average is the intersection of the time when musicians' careers peak, and when their muscular and neurological systems start to lose resilience. In other words, any unhealthy or overly strenuous work will catch up to them at this point.

There were considerably more male musicians participating in the study than female musicians, with 81% of the participants being male.<sup>30</sup> This data may imply that male musicians are at higher risk of developing FD, but the study's sample size is not large enough to make any definitive claims. Furthermore, the prevalence of gender inequality in classical music could obscure the data.

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<sup>28</sup> Jabusch and Altenmüller, "Focal Dystonia in Musicians: From Phenomenology to Therapy," 210.

<sup>29</sup> Ibid., 208.

<sup>30</sup> Ibid., 208.



The musicians who participated in this study were professional musicians working as soloists, orchestral musicians, chamber musicians, teachers, and students. The distribution amongst the professions was the following: soloists were the most affected, comprising 51% of the participants, followed by orchestral musicians and teachers, each being 17%, and students being 15%. The large percentage of soloists could be attributed to the strain of mastering and frequently performing a considerable amount of repertoire.<sup>31</sup> Even though the number of affected orchestral players was smaller, those orchestral players with FD may have been affected by unhealthy posture from the sheer number of hours spent sitting in a tight space on the stage, in instrumental pits, or in rehearsal spaces.

Most of the participants (95%) were classical musicians, and the rest were either jazz or pop musicians.<sup>32</sup> It is arguable that the technical and artistic demands of classical music present a tremendous challenge on soloists and other performers. Meanwhile, genres like jazz and pop allow more artistic freedom, and place fewer constraints on the performers.

The musical genre of the overwhelming majority of patients was classical music. In contrast to pop or jazz music with improvised structures and great freedom of interpretation, musical constraints are most severe in classical music. The latter requires maximal temporal accuracy in the range of milliseconds which is scrutinized by the performing musician as well as by the audience at any moment of the performance. This, as a consequence, combines the situation of public performance in classical music with a high level of social pressure: the gap between success and failure is minimal in this genre.<sup>33</sup>

It is important to note that each country has unique cultural values and aesthetic preferences, which may determine the breakdown of musicians by genre. Had this study not been conducted in Germany, but elsewhere, the data may have varied significantly.

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<sup>31</sup> Jabusch and Altenmüller, "Focal Dystonia in Musicians: From Phenomenology to Therapy," 208.

<sup>32</sup> Ibid., 208.

<sup>33</sup> Ibid., 211.

## CHAPTER 2: TREATMENTS

Patients suffering from Focal Dystonia may confront two major challenges in attempting to find treatments. The first obstacle is that there is no available cure that works for all patients. Despite the existing range of treatments for FD, there is currently no single, proven cure that can consistently and completely eliminate the symptoms for all patients. Rather, every case is different, and the available treatments may or may not work depending on an individual's circumstances, medical history, and specific condition. The second obstacle is that there is a lack of information about the existing and potential treatments. It is impossible to develop a consistent treatment protocol that targets a wider range of cases without more research; however, it has been difficult for researchers to find sufficient case studies and data. The studies themselves are rare, and even in the more fruitful studies, often some of the data is rendered useless, in large part due to frequent subject attrition. The most common reason for subject attrition seems to be the patients' inconsistency in compliance, patience, and motivation to undergo long-term treatments. Because FD treatments often last for years, a pertinent study must last at least as long, to accurately track the patients' recovery process.

Nevertheless, thanks to emerging research on neuroplasticity,<sup>1</sup> there are several alternatives for alleviating the symptoms of FD. Many musicians suffering from FD have spent time, money, and effort seeking the appropriate medical care. With sufficient information, a patient may bypass unnecessary expenditures of energy and resources. Thus, this chapter is designed to aid musicians affected by FD by exploring several treatment options that may suit their individual circumstances. This chapter will cover sensory motor retuning (also known as behavioral therapy), sensory re-education, and pharmacologic treatments.

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<sup>1</sup> The ability of the brain to change in structure or function in response to environmental factors; the ability of the nervous system to adapt to trauma or disease.

A proper diagnosis is essential to developing a suitable treatment plan. According to medical researchers Leslie Cloud and HA Jinnah, “The therapeutic approach, which is usually limited to symptomatic therapy, must . . . be tailored to the individual needs of the patient.”<sup>2</sup> Each patient’s needs are determined by a number of different factors, including age, occupation, and overall health. For example, if the age of onset for the patient’s condition is below thirty years (also known as “young-onset disease”), that patient is more likely to suffer from a progressive, widespread, and generalized form of dystonia. In contrast, a patient whose onset occurs after the age of thirty is more likely to develop a specific, localized version of the disease. Along with the abovementioned factors, the form of the condition (whether it be more generalized or focal) greatly influences the kinds of treatments that might be effective.

The possible treatments for FD can be divided into two general categories: one involving prescribed medications, and the other relying on physical training. The first category includes a variety of oral and injected medications. The second, which includes external stimulations and specific activities, relies on a nuanced understanding of how the nervous system works, and its role in playing an instrument. Both approaches work differently within our bodily systems; thus, patients must carefully weigh the benefits and drawbacks of each treatment. The therapies, retraining methods, and exercises introduced here may not be the ones that the reader will eventually choose. Ultimately, patients should consider all possible treatments in depth before developing their own approaches to exercises and therapies.

## **A. Pharmacological intervention: Botulinum Toxin injection and Trihexyphenidyl**

### **A-1. Botulinum Toxin injection**

In some cases, a Botulinum Toxin injection (commonly known as Botox injection) has been shown to alleviate dystonic symptoms in musicians. Botox is a common treatment for many movement

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<sup>2</sup> Leslie Cloud and H. A. Jinnah, “Treatment Strategies for Dystonia,” *Expert Opin Pharmacother* 11, no. 1 (January 2010): 5

disorders, including overactive muscle activities, like the spasms and muscle contractions typical in FD.

According to the national support organization and charity Dystonia UK:

The toxin affects the nerves where they meet the muscles and reduces the excess muscle activity caused by dystonia. It acts as a blocker preventing release of the chemical messenger acetylcholine which is responsible for making the muscle contract. As a result, the signals that would normally be telling your muscle to contract are halted and the muscle spasms are reduced or in some cases may cease completely for the length of the treatment. Although this means botulinum toxin is exceptionally toxic, when it is purified and used in small, controlled doses it is safe and can be effective.<sup>3</sup>

Nevertheless, Botox has become a controversial treatment due to its side effects, most commonly stiffness of the muscle at the site of injection, or finger immobilization. These side effects typically last three to four months, or as long as the Botox remains in the body. The reaction to the treatment depends entirely on the patient and the type of symptoms.

Due to the extensive research on Botulinum Toxin since the 1980s, and considering its safety and efficacy in treating muscle disorders, it has become one of the most standard solutions for FD.<sup>4</sup> For patients considering this treatment option, they might plan to avoid performances after the injection, in case the side effects prevent them from being able to play.

On the positive end, this treatment has saved musicians' careers. One notable case of recovery is that of the internationally renowned pianist Leon Fleisher, who was able to return to his career as a soloist after undergoing Botox treatment. In an interview with Fleisher in 2010, he explained that his symptoms were still there, but Botox injections every four months allowed him to manage the condition.<sup>5</sup> In contrast

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<sup>3</sup> "Botulinum Toxin Injections," The Dystonia Society, accessed October 13, 2020, <https://www.dystonia.org.uk/botulinum-toxin-injections>

<sup>4</sup> For more information about the history of Botulinum Toxin Injections, see: "Botulinum Toxin Injections for Movement Disorders," UW Health, accessed October 13, 2020, <https://www.uwhealth.org/neurology/botox-injections-for-movement-disorders/20607>; "Botox Injections," Mayo Clinic, accessed October 13, 2020, <https://www.mayoclinic.org/tests-procedures/botox/about/pac-20384658>; and Jabeen, Afshan et al., "Guidelines for the Use of Botulinum Toxin in Movement Disorders and Spasticity," *Annals of Indian Academy of Neurology* vol. 14, Suppl 1 (2011): S31–4.

<sup>5</sup> Leon Fleischer, "My Life Fell Apart..." Interviewed by Lynn Walker. *Culture*, The Independent, May 30, 2010, <https://www.independent.co.uk/arts-entertainment/music/features/leon-fleisher-my-life-fell-apart-1984408.html>.

to Fleisher’s story, wind players with embouchure dystonia have not shown any promising results using Botox injection, and most of them complained about its side effects at the injection site.<sup>6</sup>

Even though the effects of Botulinum Toxin disappear after a few months, the procedure needs to be done with care. A specially trained doctor should administer an accurate dosage at a precise location. To pinpoint the correct muscle area, physicians will often use electromyography (EMG)<sup>7</sup> during an injection procedure.<sup>8</sup> Some drawbacks of the treatment include doctor’s appointments every three months, the expense of the injections, and the aforementioned risks.

## **A-2. Trihexyphenidyl**

Several oral medications can treat the various types of dystonia, such as anticholinergic agents, presynaptic receptor agonist, dopaminergic agents, benzodiazepines, or clonazepam. Of those, anticholinergic agents<sup>9</sup> are generally known to be the most successful oral medications for the treatment of dystonia, with trihexyphenidyl being the most common. Other anticholinergic agents include benztropine, biperiden, atropine, procyclidine, orphenadrine, and scopolamine.<sup>10</sup> Trihexyphenidyl is a medicine that can also address the symptoms of Parkinson’s disease, but it is not a cure for either FD or Parkinson’s, because it only alleviates symptoms, including movement disorder, tremors, postural instability, spastic contractions, and psychotic depression.<sup>11</sup>

Some of the patients who were treated with trihexyphenidyl experienced side effects such as headaches, dizziness, memory loss, confusion, blurred vision, dry mouth, nausea, constipation, drowsiness, insomnia, nightmares, among others. Indeed, I noticed some of these side effects myself in the brief period that I took the medicine. Compared to what others may have experienced, the side effects that I felt were relatively mild, since I was on the minimum dosage. According to the statistics on this

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<sup>6</sup> Altenmüller and Jabusch, “Focal Dystonia in Musicians: Phenomenology, Pathophysiology, Triggering Factors, and Treatment,” 5.

<sup>7</sup> A diagnostic device to measure muscle responses by stimulating the nerve cells.

<sup>8</sup> Cloud and Jinnah, “Treatment Strategies for Dystonia,” 13.

<sup>9</sup> These inhibit nerve impulses responsible for involuntary muscle movements and various bodily functions.

<sup>10</sup> Cloud and Jinnah, “Treatment Strategies for Dystonia,” 6.

<sup>11</sup> As addressed earlier in Chapter 1, both conditions share certain traits typical of movement disorders.

medication, children respond to higher doses of trihexyphenidyl better than adults, who often experience the side effects of the drug more severely. Moreover, as explained by Cloud and Jinnah in their article on treatments for dystonia, “Patients [who] started on anticholinergic agents within 5 years of onset are more likely to experience therapeutic benefit.”<sup>12</sup>

## **B. Physical training: Sensory motor retuning and Sensory re-education**

For some patients, physical therapies—such as relearning new techniques by exploring and engaging unaffected muscles—may be more effective than taking prescribed medications. Altering the posture when holding the instrument can be one way to engage different, non-affected muscle groups. For example, I changed my left thumb position on the neck of the violin, so I could avoid having my dystonic finger collapse when attempting to keep it rounded. This altered thumb position enabled me to engage a previously latent part of my index finger. Even though using a different part of the finger would not be the ideal position in normal circumstances, considering the intensity of my symptoms, the change was extremely useful in my rehabilitation. The adjustment itself was so subtle that it did not take very long to adjust to the new posture; however, it did require several attempts to find one that would work consistently.

Relearning or retraining a new muscle also has disadvantages, as it takes a great amount of time, endurance, and resourcefulness to construct new techniques from scratch. In addition, there is the lingering possibility of a relapse of dystonic symptoms when learning a new technique, because applying a prior working method in a new muscle area can result in similar injuries. Since retraining is a long process—often as long as two to three years—and requires immense fortitude from patients, many of them give up on this type of treatment. If patients are young enough to cultivate another passion or interest other than their original professions, their doctors may occasionally encourage them to change career paths.<sup>13</sup> For many, this can be very discouraging, and can prompt such psychological conditions as anxiety and depression.

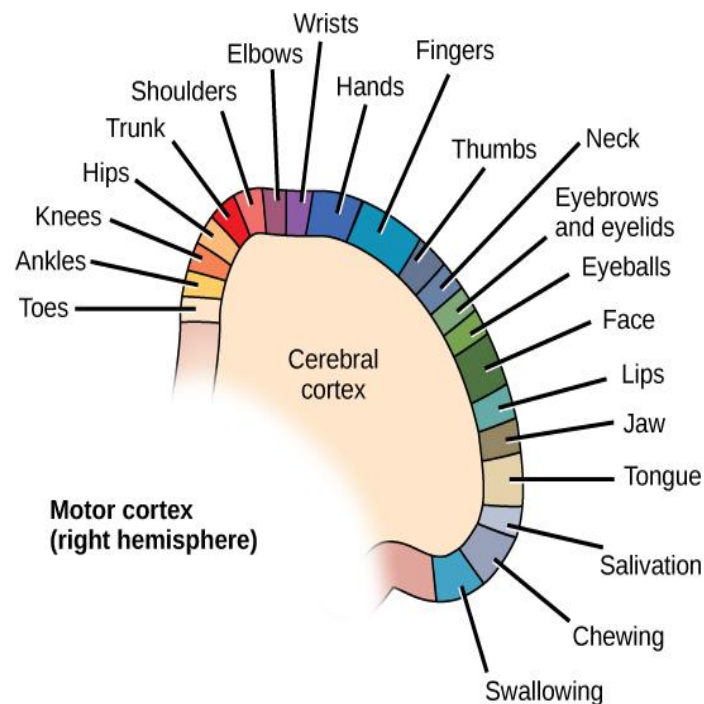
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<sup>12</sup> Cloud and Jinnah, “Treatment strategies for dystonia,” 6

<sup>13</sup> Jabusch and Altenmüller, “Focal Dystonia in Musicians: From Phenomenology to Therapy,” 217.

## B-1. Sensory motor retuning

Sensory motor retuning is a therapeutic approach that redirects neural signals to reduce dystonic movements. This treatment improves alterations in the somatosensory map,<sup>14</sup> which are commonly found in patients with movement disorders of the hands. As shown in Figure 8, for example, cortical representations<sup>15</sup> in a somatosensory map created by magnetic source imaging demonstrate that the most stimulated and trained digits were enlarged.<sup>16</sup>



**Figure 7: Motor cortex (Right hemisphere)<sup>17</sup>**

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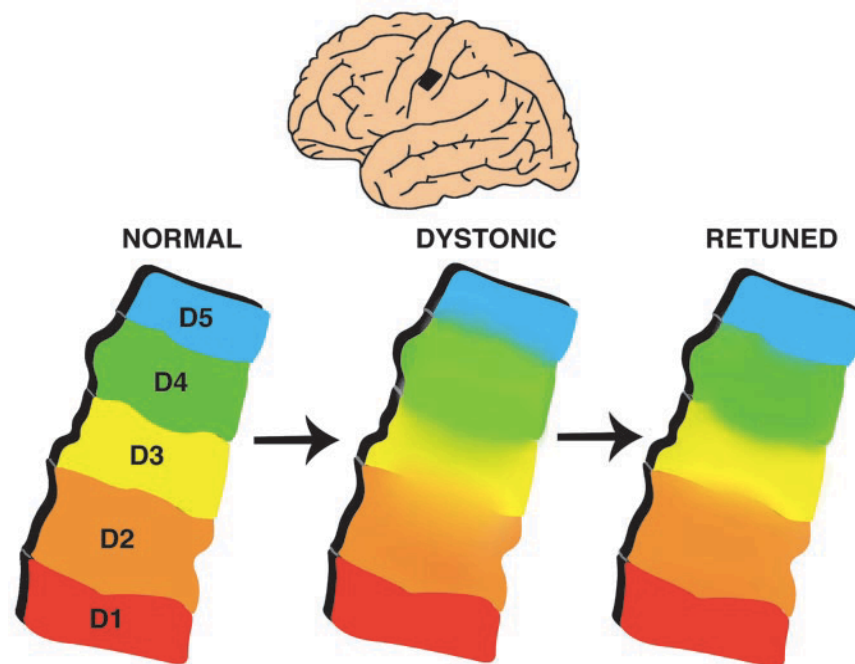
<sup>14</sup> This depicts the locations where the sensation of each part of the body is interpreted in the cerebral cortex.

<sup>15</sup> These represent each part of the body in the cerebral cortex.

<sup>16</sup> Randolph J. Nudo, "Retuning the Misfiring Brain" *Proceedings of the National Academy of Sciences in the United States of America* 100, no. 13 (June 2003): 7425.

<sup>17</sup> "Motor Cortex" Wikimedia Commons, accessed October 13, 2020, [https://commons.wikimedia.org/wiki/File:Figure\\_35\\_03\\_04.jpg](https://commons.wikimedia.org/wiki/File:Figure_35_03_04.jpg)

In this approach, a splint is attached to non-affected fingers or areas to immobilize them, allowing the patient to train or strengthen the affected finger or muscle area independently. Immobilizing the non-affected areas inhibits the compensatory or abnormal movements that result from finger dystonia, and can re-establish independent movement of the affected muscles. As shown in Figure 8, this behavioral therapy supports the hypothesis that the representation of hands in the cortex is altered by repetitive tactile stimulation. This alteration can appear during the process of learning a new sensorimotor skill: for instance, learning to play a new arpeggio on a guitar.<sup>18</sup>



**Figure 8.** This illustration depicts hypothetical alterations in the topographical representation of the hand in the somatosensory cortex (the black rectangle on the picture of the brain shows the location of the area represented in the colorful diagram). Normally, the cerebral map is characterized by an orderly sequence from D5 (little finger) laterally to D1 (thumb). Boundaries between finger representations are sharp and unmistakable. In focal dystonia of the hand, the boundaries between the finger representations have degraded, resulting in cortical regions that represent large skin surfaces crossing multiple digits. In the article by Candia et al. (26), sensory motor retuning was able to reduce dystonic symptoms. After the therapy, “retuned” maps appeared normalized.<sup>19</sup>

<sup>18</sup> Nudo, “Retuning the Misfiring Brain,” 7425.

<sup>19</sup> Ibid., 7426.



Another example of alterations of hand representation in the brain comes from a study on non-human primates conducted by Clark, Allard, Jenkins, and Merzenich. The researchers “...surgically connected the skin surfaces of two adjacent fingers in a so-called digital syndactyly<sup>20</sup> preparation. Several months later, the normal somatotopic boundary between the two digits were blurred.” A different study, on neuroimaging of the somatosensory cortex in human subjects with focal hand dystonia, yielded similar results. This abnormal phenomenon—i.e., somatosensory map distortions in the cortex—suggests that focal hand dystonia is a complication derived from excessive motor outputs. Dystonic symptoms can form when these outputs are specifically related to highly skilled hand movements that overwhelm a certain muscle area (such as over-playing). For example, a musical passage that requires the fingers to twist for a complex chord progression can create tension in the hand. Once the muscle strain puts sufficient stress on the hand, certain muscle groups may cling together, which may promote a dystonic process.<sup>21</sup> Therefore, the physical treatments that immobilize different muscle areas are effectively retraining the muscles to act separately.

Based on the distorted somatosensory maps, sensory motor retuning therapy focuses on retrieving the ability to move the dystonic finger individually, and consequently reducing muscle contractions. According to Randolph J. Nudo, a few days after the therapy, the patients in his study reported that their dystonic fingers were more in control, signifying that they had regained some independence of motion in the affected areas. As shown under the “retuned” category in the graph in Figure 8 above, the representation of the hand in the somatosensory map had become sharper again.<sup>22</sup>

## **B-2. Sensory re-education**

Sensory re-education is, as the term itself suggests, the re-education of how movements are sensed in the brain. This therapy focuses on the retrieval of physical sensation and control in the affected hand, through a series of sensory discrimination activities. These activities require the patient to decipher

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<sup>20</sup> Syndactyly is a condition in which more than two digits (fingers or toes) are joined together either by skin and soft tissue or bone.

<sup>21</sup> Nudo, “Retuning the Misfiring Brain,” 7425.

<sup>22</sup> Ibid., 7426.

information through touch, such as identifying various textures, matching pairs of objects, and reading braille. The concept is to help the patients to remember how they sensed movements before FD.

In addition to sensory discrimination activities, patients are asked to play two musical pieces: one easy and the other more technically demanding. At the beginning of the training period, patients will play both pieces at a slower tempo, and learn to minimize or eradicate any involuntary movements. Patients are encouraged to use a metronome to maintain the tempo throughout each training session, and to monitor a gradual increase in tempo every week. In my experience, it was not possible to play without any dystonic movements, even when the tempo was very slow; however, I learned how to keep the dystonic movements as small and rare as possible. The most crucial aspect of this training method is finding an appropriate initial tempo. If during the next week the increased tempo is impossible to play without involuntary movements, the patient should keep the previous tempo for a few more days, or until there has been sufficient improvement. During the retraining, patients may use a mirror to provide immediate visual feedback of the affected area while trying to control their movements. By observing themselves play with little to no dystonic movements, patients might be able to recall their normal movements before the onset of FD. Consistently following this slow-practice method will allow patients to regain muscle control within the rhythmic framework of a piece. Patients need to practice this exercise daily for about thirty to sixty minutes. This is a gradual retraining process that can take up to 12 months or longer, as needed. As with all other rehabilitative therapies, the slow-practice method requires commitment, motivation, and compliance. Retraining can be quite challenging, because, as Butler and Rosenkranz have explained, “the same amount of repetition may be needed to restore the hand representation as that which led to its degradation.”<sup>23</sup>

While sensory motor retuning corrects neurological pathways by separating the unaffected parts of the body from a dystonic finger, sensory re-education takes the opposite approach. The latter increases

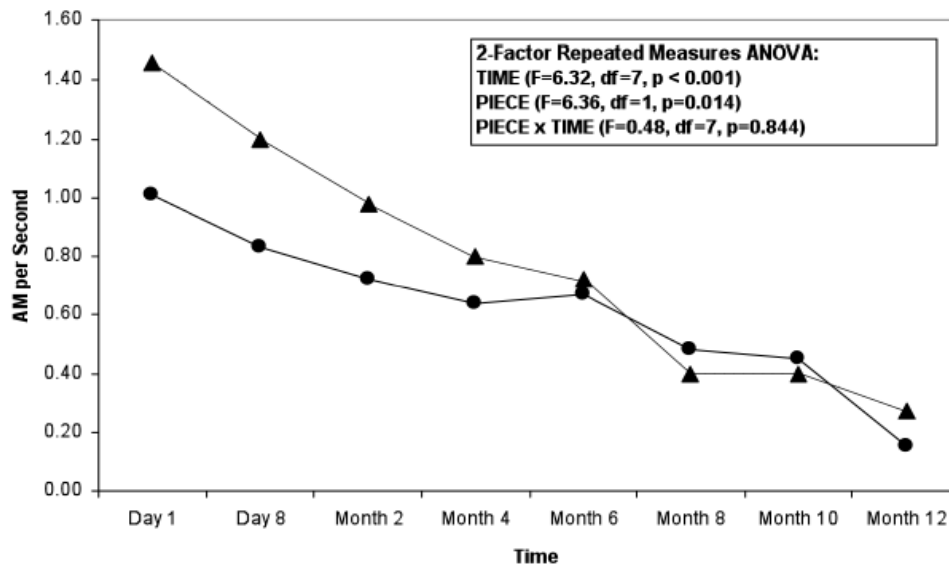
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<sup>23</sup> Katherine Butler and Karin Rosenkranz, “Focal Hand Dystonia Affecting Musicians. Part II: An Overview Of Current Rehabilitative Treatment Techniques,” *Hand Therapy* 11, no.3 (September 2006): 80.

the sensitivity of the dystonic finger, so that the brain can recognize the individual finger again. Sensory re-education helps patients reduce abnormal movements and retrieve their sensory motor control, which directly reverses the somatosensory map distortions. The deteriorated sensory motor control may be attributed to the alterations due to the plasticity in the sensory cortex. The rehabilitative exercises of both methods (sensory motor retuning and sensory re-education) will be covered again later, along with detailed procedures and explanations based on my experience.

### **B-3. Comparisons between the physical retrainings**

Researchers have found that sensory re-education and sensory motor retuning treatments were most effective when administered simultaneously. In a study conducted by Patrice Berque, Heather Gray, and Angus McFadyen in Glasgow, Scotland, patients volunteered to participate in the study, and assessed their progress after 12 months of a combination of what they called constraint-induced therapy and motor control retraining (alternative names for sensory motor retuning and sensory re-education). In the frequency test of abnormal movement (which tracks how often involuntary movements occur), the patients showed a drastic improvement with both easy and more difficult pieces after 6 months of training. After 12 months, the frequency had nearly reached a normal level. The graph below (Figure 9) indicates the frequency of dystonic movements (which in this study is referred to as Abnormal Movements “AM”, compared to the number of months that the piece was practiced). The respective difficulties of both pieces (easy and intermediate) are represented by either a circle (easy) or a triangle (intermediate).



**Figure 9. Frequency of abnormal movements (AM) scale: mean values for each piece and all subjects. Easy piece, circles; medium-difficulty piece, triangles.<sup>24</sup>**

In another study conducted by Butler, Sadnicka, and Freeman, patients with focal hand dystonia underwent a rehabilitative intervention with four different treatments, including sensory re-education, sensory motor retuning, mirror therapy, and slow-down exercise, along with complementary hand therapies. The process of this study was quite similar to the Glasgow study, except this research spanned only six months. This study included hand therapies such as soft tissue massage and ultrasound therapy to reduce the pain for compensatory movements.

The study provided the subjects with a few specific exercises for the forearm, shoulder, and hand during the training session for use as in-home exercises. Eight of the participants were suffering from musician's dystonia (focal hand dystonia), and seven had writer's cramp (also a form of focal hand dystonia). Two participants resigned in the middle of the treatments because their belief in the process waned, and a third participant also stopped receiving treatment on the tenth week, after developing an unrelated health issue. Therefore, twelve participants (80% of the sample size) completed the study. At

<sup>24</sup> Patrice Berque, Heather Gray, and Angus McFayden, "A Combination of Constraint-induced Therapy and Motor Control Retraining in the Treatment of Focal Hand Dystonia in Musicians," *Medical Problems of Performing Artists* 25, no. 4 (December 2010): 157.

the end of the survey, the authors interviewed the participants for a review of their experiences. The remaining seven patients with musician's dystonia reported sensory motor retuning to be the most effective treatment (86%), followed by the slow-down exercise (71%), and mirror therapy and exercises for shoulder and hand (43% each). Alternatively, the patients with writer's cramp reported hand strengthening exercises to be the most effective (80%) and sensory motor retuning, exercises for shoulder, and slow-down exercise all equally effective (60% each). None of the participants reported either soft tissue massage or ultrasound therapy to be effective.<sup>25</sup>

Although these studies do not quantitatively evaluate how much the patients improved, these therapies—either one at a time or combined—seemed quite beneficial for the participants and showed promising results. Personally, I can vouch for slow-down as one of the most effective exercises I have tried. The slow tempo provides the time to observe how the dystonic finger affects other fingers while playing, and allows time to react if these motions begin to surface. It is very important to observe all movements with a keen awareness during the training, lest the movements pass unheeded. Dystonic movements are subtle and fleeting, and catching them in real time can be a challenge; therefore, the slow-down exercise can counteract these difficulties.

Because both studies were long-term commitments for participants, they were obligated to maintain their motivation throughout the rehabilitation process. Coping with this condition is definitely challenging and time-consuming, but the patients can expect positive results from these retraining exercises under proper guidance.

#### **B-4. Complementary therapies**

In addition to physical therapy and medications, there are a number of complementary therapeutic approaches that can alleviate some of the natural stressors that occur with playing a musical instrument. Holding an instrument, for instance a violin, can have adverse effects on the body if not properly executed. The correct posture for holding a violin is asymmetrical. The left and right arms and hands of a

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<sup>25</sup> Katherine Butler, Anna Sadnicka, and Jennifer Freeman, "Sensory-motor Rehabilitation Therapy for Task-specific Focal Hand Dystonia: A feasibility study," *Hand Therapy* 23, no. 2 (March 2018): 9.

violinist work completely differently from each other, because they have different functions; therefore, coordination is a particular challenge for string players. In violin performance, the spine and neck are more at risk of injury because of the awkward posture required to support the instrument. If one holds the violin for too long with too much physical involvement—very typical during performances—it disturbs the body alignment, and in compensation for the lack of balance, puts excessive strain on smaller muscles.

Fortunately, body awareness is fashionable these days, and various practices are available and accessible, such as yoga, Pilates, and meditation. Other disciplines, such as Alexander technique, Feldenkrais, and mindfulness training, are also effective for increasing bodily health and awareness. These methods will benefit musicians seeking to ease injury symptoms or pain, as well as those who are healthy, and looking to maintain health and gain more physical freedom. These therapies cannot cure FD; however, along with medical treatments, they will help people improve their postures, and facilitate recovery. There is no scientific proof that body work can improve FD symptoms, but many musicians have found it helpful. Even many physical or clinical therapists for FD recommend that patients combine target treatment methods with these complementary therapies.

Maintaining bodily health can support a positive mindset during treatment. Many patients with FD experience discouragement, depression, and a lack of motivation during rehabilitation, because of the challenges and fears of coping with the disorder. In order to endure this exhausting process, patients need to feel empowered and optimistic. In my case, though I still struggle with dystonic symptoms, I persevered through the most trying stages of recovery. I can say definitively that a positive mindset is necessary. Had it not been for the incredible support of my loved ones, I would have quit.

One type of complementary therapy is soft tissue massage, which can ease any of the physical pain from dystonic movements. FD alone does not cause pain normally, but patients can develop secondary pain from the effort of compensating for dystonic movements.

While easing these symptoms is important, strengthening the affected area targets the root of the problem. At the beginning of the onset of focal hand dystonia, the affected finger typically suffers from

spasms, collapsing, and tremors. At this point, compensatory movements from non-affected fingers will become necessary to keep playing (not a viable solution, of course). In order to regain control of the dystonic finger, the affected muscles must have independent mobility. There are a few ways to strengthen these muscles, and such exercises can be found in the appendix.

Some musicians know instinctively how to use their bodies when they play. They naturally engage the required muscles and body parts for a passage or piece. While this lack of thought can be a coveted trait, a consciousness of the body is key to its proper functioning of the body. As discussed earlier, many physical therapists recommend using a mirror to receive immediate feedback, to help patients remember their previous, controlled movements before the onset of FD.

To help recall the feeling of my hand before FD, one method that I tried was playing on a “left-handed violin.”<sup>26</sup> The purpose was to train myself with my healthy hand. I taught myself as if I were a beginner, and tried to learn the natural hand position and movements with my right hand on the strings. The sensation of playing the left-handed violin was very awkward, and it was almost impossible to play anything at first. There are a few violinists suffering from injuries who have learned how to play on these types of instruments, and they have continued their professional careers successfully. I can only begin to imagine how much effort they have put into learning a reversed instrument—probably almost the same amount of time and effort as a beginner would. It is, however, not impossible to learn and play on those instruments, and it can be a way for string instrumentalists to keep playing while suffering from FD.

On the subject of remembering the normal movements, visualization was one of the most helpful exercises in improving my dystonic symptoms of those that I have tried. Visualization practice requires a high level of concentration to remember all tactile sensations, such as joint movements, movement relationships with adjacent fingers, hand positions, and so on. Retrieving the memory of how my whole body felt on the violin before the onset of FD helped me to regain control and strength in my finger. An important step of the visualizing exercise is to imagine playing the violin and feeling the strings beneath

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<sup>26</sup> Left-handed violins are instruments that are customized to be held by the right hand and bowed by the left hand.

the fingers, before actually playing the violin. During this process, it might be helpful to imagine playing without abnormal movements, both while visualizing, and while actually playing. When starting this exercise, it is important to carefully place the fingers on the string with minimal pressure. After a few days of practicing this way, patients can gradually increase the amount of pressure on the strings, while keeping the same feeling of lightness and control. In order to achieve the right movements, slow-down practice can be helpful in this exercise as well. The tempo for the slow practice should be as slow as is necessary to eliminate any dystonic movements from normal hand movements.

This chapter has surveyed many effective types of the medical and therapeutic interventions that can improve musician's dystonia. Even more therapies may exist than those that I have included. Each method is effective in a specific way, and exploring the various therapies can allow patients to determine the best combination for themselves. While patients may become frustrated when committed to a long-term treatment because the results can vary widely, it is worth it, however, to try one particular therapy for about a year to see if it is effective. Proper guidance and patience are essential to staying motivated and to enduring the retraining periods. Compared to the amount of time and investment dedicated to mastering an instrument, a year is short, yet can prove significant in overcoming some of the losses that FD can incur. In the next chapter, I will discuss in detail my own experience with all of these different therapies, and identify which ones proved most useful for me.



## **CHAPTER 3: PERSONAL EXPERIENCE AND APPROACH**

I cannot say definitively how I developed focal dystonia, but with hindsight I can discern a variety of factors that may have induced the condition. My entire life up until the injury seems replete with risk factors—those being certain aspects of my personality, or habits set in my childhood, or significant life events in the year that I developed FD. To examine all of these potential catalysts, I will spend this chapter recalling the relevant details of my childhood, early education, the time of my FD onset, and the stages of my rehabilitation.

Although physical injuries are quite common, musicians are often hesitant to disclose their struggles, due to the competitive nature of the field. This stigma has left musicians uninformed at best, and helpless at worst. Better dialogue among affected musicians, and more transparency in case studies, could help to significantly advance the general knowledge, research, and solutions for those in need. As of now, musicians lack vital resources on FD and other complex or elusive conditions. I am sharing my personal story not only to inform musicians who are at risk or affected, but to demonstrate that sharing one's experience benefits all.

### **A. Childhood**

Classical music study requires many hours of practicing, and so one must take measures to prevent excessive muscle use and fatigue. During my childhood, I developed practicing habits and a mindset that desensitized me to my body's signals.

I started playing the violin at the age of seven. My brother was already learning the instrument at that time, and it sparked such a keen interest in me, that I often snuck into his room to make some noise on his violin. I must have loved playing musical instruments, for my mother jokingly recalled that I often lied to her about how much I had already practiced so that I could practice more. My parents supported my love of the instrument by giving me lessons with great teachers, who in turn gave me the tools to

progress. By the time I was in elementary school, I had won several national competitions, and I decided to make a career in music. I attended specialized middle and high schools and received excellent grades throughout my musical education. My motivation led me to practice at night, when I could concentrate the best, instead of sleeping.

I was raised in a very strict family. Because of my parents' devotion to education, I worked diligently under strict, and at times severe, violin teachers. Surrounded by expectations, I had to prepare for my lessons at a very high standard. I enjoyed practicing difficult passages, and I felt rewarded in overcoming challenges; however, after a while I became unsure of whether I was playing more for my own happiness or for that of my parents and teachers. Playing was becoming more of a chore to me, and I practiced only to avoid missing notes. I grew increasingly self-critical, to the point where I would expect perfection from myself. I was told that I should be able to play my repertoire at any time, even right after waking up in the middle of the night, without warming up. Even for my severe teacher, my practice schedule was too extreme. Once, after having observed a lesson, I practiced scales for an entire day. I practiced with the constant fear of failure and disappointment, fortified by the belief that I could make any piece work if I just put in the hours. I did not give myself sufficient breaks, and my muscles had little time to recover from their excessive strain. I became so accustomed to long, uninterrupted practice sessions that they became habitual.

Since then, I have learned that the key to productive and healthy practicing is to have a clear practice plan with specific goals. I have also realized that there were more rewarding aspects of playing music than avoiding mistakes. While a classical musician must perform as faithfully as possible, thoughtless and joyless playing can harm the mind and the body, especially when the mind and body are disconnected. Had I approached my practicing more mindfully, I might never have developed FD.

## **B. My personality**

In high pressure situations, such as competitions, recitals, and auditions, one's personality and mental resilience are critically important. Those with shy or timid personalities may experience anxiety in navigating a very extroverted professional field, which is rife with criticism and judgement.

My strict parents raised me to be an obedient, introverted, and composed child. I was taught to be humble and kind to others, and I seldom challenged authority. I was more often reprimanded for my bad habits rather than complimented for my strides and progress, but I was impressionable, and believed that I would be better for it. In reality, I did not learn how to love or care for myself. I began to focus more on my flaws than on my strengths, and I lost faith in myself.

The quality of one's performance depends on confidence and positivity. Self-doubt will cause anxiety about public performances, and can lead to a wide range of destructive tendencies. Although there is no scientific proof of connection between anxiety and FD, I believe that my struggles with self-confidence and perfectionism contributed to the onset of FD during a high-stress period of my career.

## **C. Life events**

In the fall of 2012, I came to Indiana University to pursue a master's degree with the late Professor Ik-Hwan Bae, whom I had known since I was twelve years old. At this time in my life, I was highly focused on developing my performance career. I began preparing for an international competition in early 2013, and I spent most of my days practicing. About two weeks before the pre-screening deadline, I was recording three different pieces: two caprices from Paganini's Op.1, and a Mozart sonata. Simultaneously, I was preparing for a friend's solo recital, which featured completely different repertoire. Though I had a lot on my plate, I had the capacity to succeed. The problem was that I did not take enough breaks to physically rest. I loved playing those Paganini Caprices, but my habit of intense self-criticism resurfaced, and I fell into a cycle of negative behaviors. There were so many little things that were not "perfect," that I could never record a satisfying take. I spent every available minute recording the same piece over and over, or practicing obsessively, day in and day out. I never felt that there were enough hours in the day to make a "perfect" recording. Since that year was my last chance to enter this

competition due to age limits, I started being very picky about my technique, while my enthusiasm and inspiration for the music faded. My habits became robotic. I would go to school at six in the morning to find an empty hall that I could use for extra recording sessions. After a while, I started noticing extreme soreness and fatigue in my body, but I kept pushing myself to create “better” recordings, never being fully satisfied. When the application deadline arrived, I finally succumbed and submitted one of my many imperfect recordings. But in the end, after all of my hard work, I failed to advance to the next round.

Following my preparation for the international competition in March 2013, I was practicing the last two pages (coda) of the “Rondo Capriccioso” by C. Saint-Saëns. This piece includes numerous fast and virtuosic passages. After years of technical practice, these passages did not pose a great challenge. I only needed to complete a few repetitions to make them clean and precise. Inexplicably, however, my playing felt strange; it was as if my left index finger had become slow, almost as if it wanted to “sleep.” This sensation, however disconcerting, was the only symptom. I asked a friend to observe if my fingers looked wrong while playing, or if my sound was problematic. Neither my friend nor my teacher at the time noticed anything out of the ordinary. Naturally, I practiced more to try and correct this unprecedented issue, but much to my dismay, practicing did not work. In May, I came to my teacher again, because I was having difficulty executing vibrato with the same finger; it felt too heavy to budge.

Though I did not realize it then, these were the very first symptoms of FD. I had created the “perfect storm”, through my perfectionism, anxiety, and low self-esteem; I had taught myself to disregard every natural feeling, in response to the pressures and competitive nature of my field. Before I knew it, I was in over my head.

#### **D. Onset of focal dystonia**

Frequently, the first symptoms of FD appear as an uncomfortable feeling, or a loss of control while playing. Instead of trying to push through the problem, I recommend seeking immediate consultation with doctors and teachers. Musicians are trained to overcome problems by working harder, but ironically this approach is counterproductive with FD symptoms. Forceful practicing often accelerates the development of the injury, as happened in my case.

The next few months of my life presented many changes. My Professor Ik-Hwan Bae passed away, and I began studying with my present teacher Professor Mark Kaplan. I also visited several doctors in Bloomington, Indiana to try to address the issue with my hand. During this time, I saw a hand specialist, an orthopedist, a physical therapist, an acupuncturist, and a neurologist; however, nobody could put a name to my symptoms. Several specialists recommended medical procedures related to cervical radiculopathy<sup>1</sup> and carpal tunnel syndrome, but they had no effect on my finger.<sup>2</sup> My quest for answers was fruitless, and I decided to take a break from playing my violin for a few weeks before the next school year started.

Although I do not know if I could have halted the progress of my injury, it may have been possible to slow its development had I met the right doctor sooner. As the next chapter will illustrate, the timing of treatment can greatly affect the severity of the case. It seems that the sooner one properly addresses the symptoms, the less damage can be done. While there is no concrete solution for this condition, finding the right help is essential, especially considering the immense psychological and emotional challenges that accompany FD.

### **E. Coping with the symptoms and accepting the injury**

It would never be easy to live with this condition. Before I could fully accept my situation, it took me about a year to start looking for a practical approach to treating my finger, and that was the period when my dystonic symptoms were most severe. It is heartbreaking to have lost an ability, which was, at one point, so natural. After spending years in pursuit of hard-earned accomplishments, professional musicians faced with FD may experience depression, frustration, and other psychological barriers in the process of recovery. There may never be a true cure, but there are many ways for patients to manage their

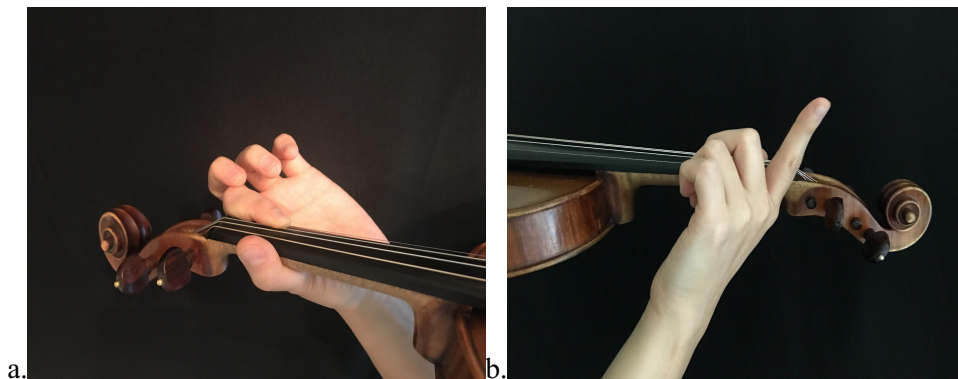
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<sup>1</sup> The nerve in the cervical spine is damaged possibly by herniated disks or arthritic bone spurs. This condition is commonly known as a “pinched nerve” or “nerve compression,” and can cause numbness, weakness, and motor dysfunction.

<sup>2</sup> I had a corticosteroid injection for carpal tunnel syndrome, and another procedure to treat nerve pressure on my left shoulder and neck. The procedure for cervical radiculopathy was an injection using a 25 gauge 2 ½ inch spinal needle. Once the needle was placed, a small amount of non-ionic dye was placed over the nerve root, followed by a combination of dexamethasone and ropivacaine without epinephrine, also placed along the nerve root.

symptoms while maintaining their career. Staying mentally strong and seeking help were, for me, the most crucial steps in accepting that I have a life-long condition.

When I came back to my violin after taking a few weeks off, I was still having a difficult time controlling my index finger. Moreover, I noticed something new: my index finger wanted to collapse and flatten (See Figure 10 below) when I tried to press down on the strings. I could no longer control the position or the placement of my finger. I experimented by looping a rubber band (See Figure 11 below) around the finger, like a splint, in order to immobilize the finger and stop it from collapsing, but this was only a temporary solution. I could not play much with the rubber band, especially over the 3rd or 4th positions—which require a different hand shape. I had a few auditions scheduled in the beginning of the fall semester. The Jacobs School of Music at IU holds a placement audition for student orchestras every semester, and because the symptoms of my dystonia were still mild, I could still play well enough to earn one of the highly competitive title chairs. I also won two auditions in regional orchestras to pay for my living expenses.





**Figure 10. Dystonic symptoms: a. My left index finger is collapsing uncontrollably, b. The index finger extends stiffly during certain patterns, c. Squeezing of the left thumb and curling of the middle finger as compensatory movements.**



**Figure 11. Using a rubber band to prevent the index finger from collapsing.**

In the same semester, I had agreed to play on a friend's solo recital and as the symptoms worsened, I pushed myself to keep playing. I did not want anyone to notice that I was having difficulties, and my desire to continue playing was growing. As time passed, my finger started feeling worse and worse. I had to struggle even with simple passages. As my finger became more problematic—trembling, squeezing with the other fingers, and extending uncontrollably—the quality of my sound was clearly suffering. I felt fearful and angry in the practice room, and increasingly frustrated when practice did not solve the problem. I was miserable, and desperate to understand what was happening. The difficulties I encountered in finding a clear cause or diagnosis only hurt me more. I became very self-conscious about

my playing, and kept my problems to myself, lest people judge my sound. I was also worried about losing my performance jobs. All of these negative emotions caused my self-esteem to plummet.

One day, my recital partner and I were playing for her teacher. The teacher criticized the quality of my sound, saying that it was not beautiful, but scratchy and squeaky. I tried to fix the problem in the moment, without revealing the problem with my index finger, but it did not work, and he continued to disparage my playing throughout the coaching session. I felt backed into a corner, and I burst into tears in front of them. I was so resentful that I could not do anything to make my sound better, and I was in disbelief at the difficulties I was facing. In that moment, I felt emotions that I am sure many FD patients have experienced: why me? I felt both lonely and exasperated because no one understood what I was going through or how to help. I could not stand that there was seemingly nothing I could do. Instead of confronting the symptoms, I was determined to hide my problem. I started to avoid using the finger as much as possible, and tried to learn how to play without it.

My teacher gave me a few finger strengthening exercises, but I could not prevent my finger from trembling or collapsing during those exercises. I shared my situation with only a few people, and they really encouraged me to have a positive mindset. It was not easy to stay positive. I started blaming myself for practicing too much without taking breaks, or practicing inconsistently, or anything I could think of that may have triggered the situation; however, I soon realized that it was too late to fix my old habits. Ultimately, I had to accept my condition regardless of the cause, and I began to seek medical guidance—an important first step in my management of FD.

## **F. Medical help**

Although the healing process can take time, the best first steps are to receive a medical diagnosis and guidance from physicians. In my experience, once the diagnosis is clear, patients will be able to treat their symptoms to some extent.

I first heard of FD from a doctor in South Korea. While on a visit in December of 2013, I consulted with a neurologist, who referred me to an orthopedist in the same hospital. When he suggested that my symptoms could be “focal dystonia,” I did not know what to expect. Since the orthopedic doctor



was not well-versed in the condition, he sent me to a specialist, who gave me diagnostic tests, such as writing with the affected hand, and checking the strength and flexibility of each finger. The tests did not last very long—perhaps about ten minutes. He formally diagnosed me with FD, and at that point, I felt relieved, because a diagnosis often comes with a cure. The doctor, however, told me the most difficult news I had ever heard in my life—that it might be impossible for me to play the violin. He had seen many careers extinguished by the condition.

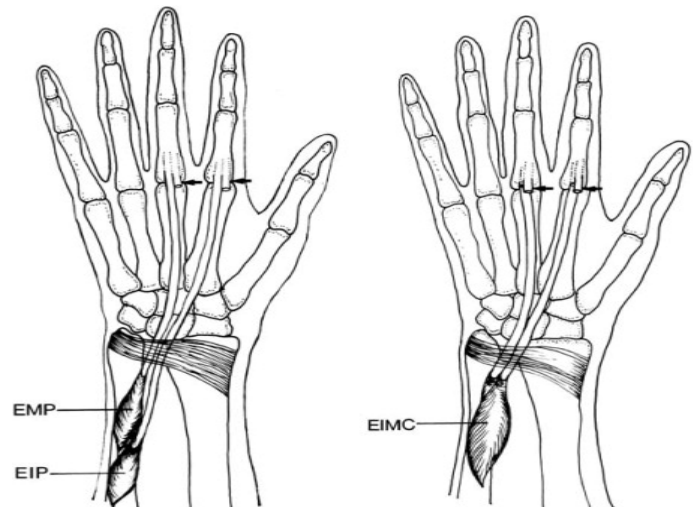
I implored him to give me a solution, and he cautiously suggested a Botulinum Toxin (Botox) injection. As discussed in Chapter 2, the Botox injection has some risks attached, but since I learned that some musicians with FD had benefited from Botox, and the procedure had no long-term risks, I decided to take the injection. The procedure only lasted about ten to fifteen minutes, but the doctor was very careful with the dosage and the location of the injection. The medical certificate listed the dosage and location of the Botox—dysport 50u in the Extensor Indicis Proprius (see Figure 12 below)—as well as the possible side effects and how to manage them.



**Figure 12. Extensor Indicis Proprius, a muscle linked to the index finger<sup>3</sup>**

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<sup>3</sup> The extensor indicis proprius is the muscle linked to the index finger that facilitates dexterity on the violin. (Figure 12) [https://www.handsurgeryresource.org/sites/default/files/images/EIP%20Final\\_0.jpg](https://www.handsurgeryresource.org/sites/default/files/images/EIP%20Final_0.jpg)



**Figure 13. Muscles for the index and middle fingers. Extensor Indicis Medii Communis (EIMC) is a muscle that extends the index and the middle finger, either individually or together: specifically, the Extensor Medii Proprius (EMP) moves just the middle finger, Extensor Indicis Proprius (EIP) muscle moves just the index finger<sup>5</sup>**

Unfortunately, I experienced the adverse side effects, and when I came back to the United States, I was not able to lift my left index or middle finger at all for the entire semester. Back then it was not clear why the middle finger was also affected by the injection, but in retrospect, it was likely because the muscles are very closely connected, as shown in Figure 13. Once the Botox had almost disappeared, I started doing exercises on the violin again. Since then, I have not tried the Botox procedure again.

When the injection did not work, it became clear to me that there was no quick medical solution to this condition, and I started to seek out other forms of therapy. I found a great resource in advice from other musicians who had suffered from FD.

### **G. Meaningful encounters with both patients and doctors**

In most cases of performance-related injury, musicians have no need to share their physical conditions in public, and most avoid doing so. It is a sensitive issue, and many fear workplace discrimination, or worse, the loss of their careers after revealing their “secret”. However, I have found

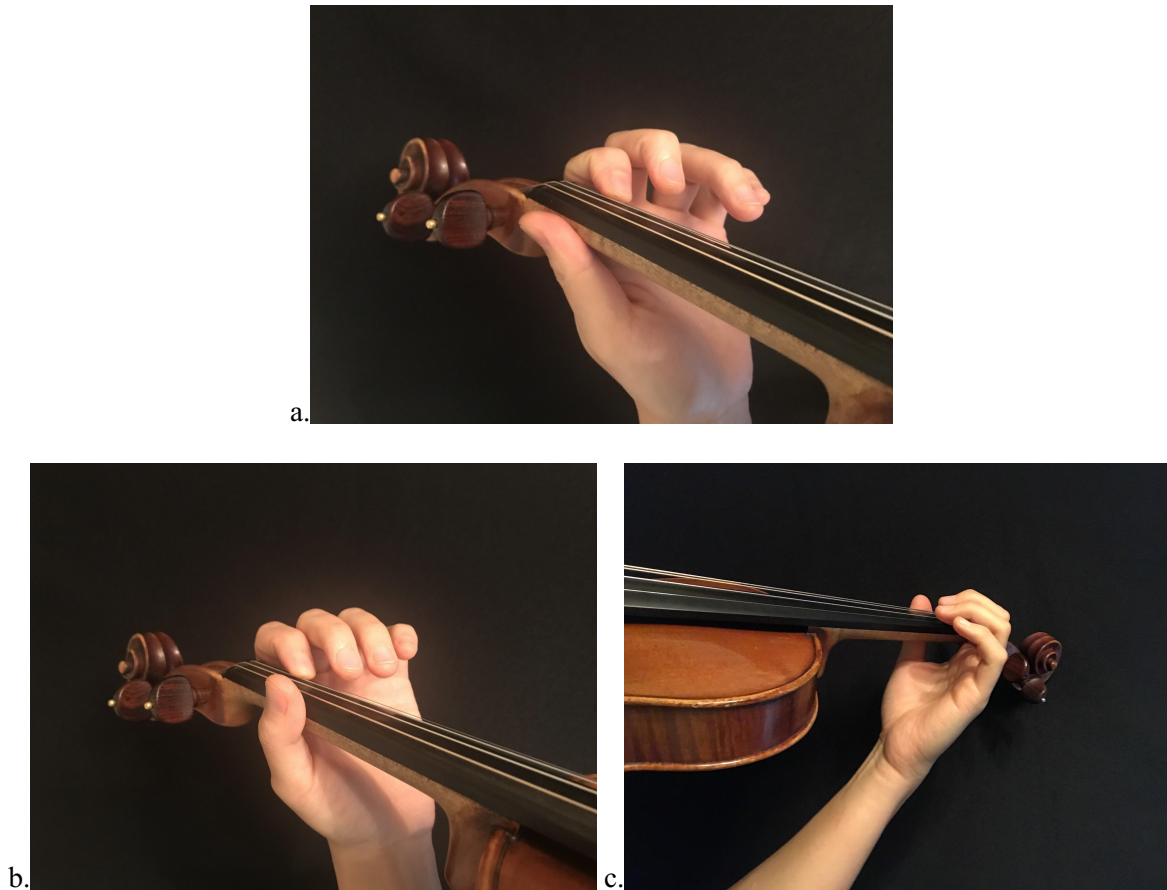
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<sup>4</sup> “Anomalous Extensor Muscles of the Hand: A Review,” accessed October 14, 2020.  
<https://www.sciencedirect.com/science/article/pii/S0363502399062711>

<sup>5</sup> “Extensor Indicis Muscle,” Wikipedia, accessed October 13, 2020.  
[https://en.wikipedia.org/wiki/Extensor\\_indicis\\_muscle](https://en.wikipedia.org/wiki/Extensor_indicis_muscle)

that the best way to understand and navigate an injury is through the advice of someone with a similar experience. Unfortunately, though, patients who need advice the most, often face an information void.

After I received my diagnosis, my teacher recalled that one of his past students had FD in the same finger, and he put us in touch. During an online meeting, she showed me a few exercises that had helped her to use her affected finger again. She had spent about a year re-educating her muscles and adjusting her technique, rather than working with doctors, whom, she said, had not helped her. She told me that, barring occasional discomfort, she has overcome the symptoms of her FD. Having an honest and productive conversation with her gave me hope. She stressed the vital importance of optimism. Until I had spoken with her, I was distraught over my situation, but she inspired me to take care of my finger. Since the effects of the Botox were still lingering, I worked on strengthening the fingers, shoulder, and neck, I used standard exercises, as well as some that I invented based on her advice. My teacher regularly gave me feedback on these exercises. After a few weeks, the trembling was mostly gone, but the finger was still hard to manage. I decided to experiment with my hand position on the violin, so as to maximize my control. I started by adjusting my thumb position. I was used to having my left thumb quite low, which compressed the thumb and index finger, but the new position aligned these fingers, so that the hand was more open and mobile. (See Figure 14 below) Next, since my left index finger kept collapsing, I examined which part of my fingertip could best support the finger on the string. Up until this point, I had not been able to use my finger at all. This new position allowed me to use it more, but I could not hold the finger down for longer than two seconds without it collapsing. As my hand was adjusting to the new posture, I felt a tightness in my left wrist. I realized that other parts of my hand (mostly the middle finger), wrist, and forearm, had been compensating for the weakness of the affected finger (Figure 10 above). The harder I placed my index finger on the strings, the more tension I felt, so this new approach forced me to learn how to relax my shoulder, my whole arm, my hand, and my left fingers.



**Figure 14. Comparison between old and new thumb positions: a. Old thumb position, b & c. New thumb position for a more relaxed hand.**

In addition to the advice from my fellow violinist with FD, I received helpful exercises and therapies from doctors and FD experts. They worked with me to strengthen the affected finger and release the tension caused by involuntary and compensatory movements. One physical therapist who helped to ease my bodily tension was a professor in the School of Public Health at IU, who had seen many cases of FD in athletes. In our sessions, we targeted the muscle knots around my neck and shoulder blades. He also gave me several exercises for my back, shoulder, arm, and hand, and taught me how to use those big muscle groups for playing the violin. In the six months that we worked together, I felt no significant improvement in my finger, but I learned how to take care of the rest of my body. Another physical therapist who helped to make strides in my treatment was a Geneva-based doctor, who treats musicians with FD. Since she had so much experience with the condition, she immediately supported me with a

positive and optimistic perspective. I have had about six training sessions with her, and found her approach to be very supportive and practical. She mentioned that she had learned through working with her patients the importance of protecting ourselves, physically and mentally, in a job that we love. She frequently mentioned how much she loves her job, and how she sympathizes with the difficulties that injured musicians face. She told me about how she had treated a well-known pianist, who had pleaded with her to keep his condition secret. She had seen that aside from the physical struggles, the greatest difficulty can be in remaining open-minded and proactive.

## **H. Research on FD**

Based on the scientific studies and statistics cited in Chapters 1 and 2, this condition seems to be more common for pianists, guitarists, and wind/brass players than for string instrumentalists. Therefore, there are fewer available methods for recovery and symptom management for strings. While it is impossible to know the exact number of affected string players, my research in this project has revealed a great need for more case studies. I chose to pursue a doctoral degree at IU as a means of expanding the research on FD in violinists. My new purpose gave me a strong motivation to improve.

The obstacle that stood between me and my doctoral program was my master's recital. I forced myself to complete the recital as soon as possible, so that I could then take the time to focus on rehabilitation. The challenge of preparing a recital program with an untreated injury was immense, but it was necessary for the sake of my educational goals. Following this recital, I had to spend a year just on strengthening my finger before beginning my next degree.

This year off from playing was mostly unhappy and discouraging. My self-doubt was intense and resilient, and exacerbated by my prior successes and ingrained perfectionism. I was not mentally prepared to confront such obstacles. I questioned my early success, and felt unworthy of it when I could not play. My fear of being judged just furthered my anxiety, which in turn fed my perfectionism in a vicious cycle. Perhaps developing FD was my body's (or my mind's) way of telling me to break that cycle. This difficult time forced me to become a mentally stronger person—thanks in large part to those who supported me with love and care. Even though this year tested my spirit like nothing else, there was one

precious thing that I gained, and would not exchange for anything: the love of music and playing violin, which I had never felt more strongly. Ironically, I wanted to play violin more than ever because I could not. Whichever music I listened to, I felt a strong desire to play, and this desire allowed me to improve. Eventually, after some serious training, I was able to return to the instrument. I could practice again during my doctorate, as well as play in the numerous professional engagements that financed my studies.

Because I had to limit my practice time, I spent my time away from the instrument mentally picturing how to use my affected finger. It required intense focus to repeatedly visualize techniques and muscle memory without the aid of the instrument. When I could use my violin, I applied what I had practiced mentally, and I began seeing some progress. This combination of hard mental and physical training ultimately made my left index finger stronger. I started using the finger more and more, but I did not force myself to use it. Over the course of several years, I tried a variety of different ways to reintroduce the finger, and expanded my approach to invent more exercises of my own. I continued my training throughout the doctoral degree, but I did not avoid performing in public.

In my extensive research, I struggled to find practical resources for violinists and other string players suffering from FD. Physical therapy and treatment with specialists are financially inaccessible to many patients, and there is a need for more available exercises and treatments that musicians can explore on their own. I found particularly challenging the lack of case studies specifically based on the experiences of string instrumentalists. My purpose in displaying my case in such detail is to begin filling the void.

This chapter has reviewed one case study (my own), and compared it with the possible contributing factors discussed in chapters 1 and 2. Later, the appendix will focus on the specific exercises and strategies that I developed in order to manage my symptoms. I have included generalized strategies, that can work in tandem with various recovery options. These techniques allowed me to slowly regain my ability not only to play, but to perform again at a high level.

## CHAPTER 4: CASE STUDIES

This chapter introduces three male string players—two violinists and one cellist—who suffered from focal dystonia. I had the chance to know these musicians through my personal acquaintances, and they all agreed to be interviewed via Zoom conference calls.<sup>1</sup> To guide the interviews, I devised a questionnaire that I sent to each of them beforehand. I have included the questionnaire at the end of this chapter. The musicians who participated in the interview for this project will remain anonymous, but I will include relevant information such as the instrument, age of onset, occupation, and the severity of their symptoms.

I would like to take a moment to thank all of the participants for their willingness to share their knowledge and personal struggles. I strongly believe that their input in this research will be a valuable resource for other musicians with FD.

### A. 1st Case

Instrument: Violin

Occupation: Orchestral musician

Age of onset: Fifty-one

Severity of symptoms: Mild

This violinist had already been playing with his orchestra for about ten years when he first showed signs of FD. Since 2005, he has experienced mild dystonic symptoms in his left middle finger. The cause of his FD is unclear, but he pointed out to me that it very likely stemmed from another injury, which he had been combatting at the time. For about three years prior to the onset of FD, he suffered from capsulitis<sup>2</sup> in the shoulder (also known as adhesive capsulitis, or frozen shoulder). He would have needed

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<sup>1</sup> The recording files from the interviews will be removed after this project is published in compliance with guidelines from the Indiana University Institutional Review Board.

<sup>2</sup> This condition involves uneasiness and pain in the joint where the shoulder was immobilized for a length of time.

time off from playing to treat this painful condition, but taking a leave from his orchestra was not an option. So, he was forced to play with the injury. His posture grew unnatural due to his shoulder ailment and thus his fingers had to compensate. After pushing himself to continue playing for a few years, his dystonic symptoms had reached the point where he could no longer lift his affected finger, once it had curled inward.

When he was diagnosed by the doctor and FD pioneer Raoul Tubiana, he started a year of treatment with a physical therapist. He worked with his PT on engaging larger muscles, and incorporating them into his violin technique. After training with some exercises, his back pain (secondary pain from dealing with FD) lightened, and he was able to use the finger again. His treatment sessions combined the mirror method and Alexander technique. The mirror method allowed him to receive instant feedback so that he could anticipate and control his dystonic movements. He also aided his affected finger by altering his left-hand position on the violin. By slightly changing his thumb placement to make his hand rounder, he regained some control of his middle finger. He focused on relaxing the first joint of the finger, and then moved the joint in a very slow and controlled manner. To allow for more physical rest, he adjusted his practicing habits by playing his instrument less, and instead visualized his technical exercises. Throughout his entire treatment period, the greatest challenge that he faced was that he could not leave his job or take a break for recovery. He managed to play, despite his physical struggles, until his retirement in 2019. Even though he still has symptoms of FD, he is able to play with incredible joy to this day.

## **B. 2nd Case**

Instrument: Violin

Occupation: Student

Age of onset: Seventeen

Severity of symptom: Severe

This violinist recalled that there were a few incidents that might have triggered FD. Until he entered university as a music student, his violin technique was sub-par—he never learned to play with a basic, healthy violin technique. For example, his left wrist always jutted out and put excessive pressure on



the muscles around the little finger, while making the rest of his fingers very tense. In his high school years, he only practiced about thirty minutes a day. He had noticed that his left arm would shake while playing, but it never bothered him enough to cause any alarm. The summer after his senior year of high school, he participated in an orchestra festival where he had to play in seven-hour-long rehearsals every day. Around the same time, he also started playing a new instrument, which forced him to adjust very fast. Yet another incident that occurred within that year, was that he had fractured his left wrist, but due to a misdiagnosis from the hospital, he went for six months without the proper care. He cannot say exactly what caused his FD, but this combination of life events may have been a factor.

During his freshman year in college, the shaking in his left arm became obtrusive. He first thought that the tremors came from performance anxiety, but that could not explain why they appeared only in certain violin positions, and only with the little finger. When he played above the fifth position or on the g string, and used the flexor muscle of his left little finger, the shaking grew completely out of control. These tremors were a result of his specific dystonic condition, which he described as weakness of the flexor muscle, and extreme tension in the antagonist muscle (the extensor). Therefore, the affected finger would lock itself in a curled position, and could not open. Initially he tried to stabilize the dystonic finger by placing other fingers beneath it, but this was hardly a long-term solution. Fortunately, he did not develop any pain from his compensatory movements.

Because the musicians surrounding him were not aware of FD, a whole year passed before he realized that his problem was neurological. Another six months passed before he could get a medical appointment, in which he was finally diagnosed. He was surprised to discover how few musicians knew about FD. Once diagnosed, he went to Germany to get treatment. He started by learning the Feldenkrais method, which helped him to relax his body, but did not target his actual problem. He tried taking trihexyphenidyl for about six months, but he could not discern any improvement, while he suffered from the side effects. Ultimately, he found that physical retraining was the most effective treatment for his symptoms.

In Berlin, he met a pianist who worked as a physical trainer for musicians with FD. They worked on muscle retraining for about six to eight months, in which they focused on identifying the dystonic location and movements, isolating the relevant muscle groups, finding an optimized hand position, and learning personalized slow finger exercises. Their purpose was to build a relaxed technique that would not trigger flexor or compensatory movements, and would stabilize the dystonic muscles. They began all of the exercises and retraining work without the violin, and then gradually applied these to the instrument. They only included the bow at the end of the process, because playing the instrument had a psychological association with his past harmful habits. After the retraining period, he regained enough control that he could place his dystonic finger on the string without tremors; however, as soon as he returned to playing repertoire, the symptoms came back. As the tremors reappeared and undermined his progress, he decided not to continue the rehabilitation.

Since the onset of his FD, he was plagued by a negative mindset, leading him to question if he would be able to recover, second guess his career path, etc. He eventually became obsessed with fixing the problem, which led him to research FD and its treatments more in depth; however, pursuing a career as a violinist was too challenging for him. He believes that there should be more resources, such as information and exercises, available for musicians, so that they can treat themselves without relying entirely on expensive treatments with rare experts. This could be accomplished through further research on comprehensive treatments, and more communication between scientists, experts, musicians, and pedagogues.

### **C. 3rd Case**

Instrument: Cello

Occupation: Teacher

Age of onset: Thirty-four

Severity of symptom: Mild

This cellist mainly teaches at a conservatory and performs in concerts. In the summer of 2017, his schedule became much busier with many different projects, while he worked at an administration office at

the conservatory where he teaches. His managing three different jobs proved rather stressful, and his practice schedule became irregular. He also has a certain degree of perfectionism. He was driven to maintain his standards through rigidity in his practice methods. Though he does not suffer from stage-fright or anxiety, at the time he felt a need to prove himself to others.

In February of 2018, he was preparing for a concert, when his left hand started to feel strange. He noticed that his little finger was less responsive than normal, but he decided not to stress about it. He already knew about FD, but the symptom was too mild to arouse his concern. The concert went well, and though nobody could tell from his playing; he had not been able to shake the unnatural feeling. Since the symptom was quite mild (and inaudible), he kept playing in concerts despite his busy schedule. About six months later, other symptoms caught his attention; he noticed more involuntary movements in his left hand, particularly in the pinky, which kept curling in towards his palm. He tried taking two weeks off from playing, but when the break was over, the issues were still there. It then occurred to him that his symptoms seemed like those of FD, and he started looking for medical help.

First, he went to see a physical therapist in Geneva, Switzerland (whom I recommended) and started training sessions. Since they lived in different countries, he could only have these sessions once a month. The physical training was very demanding, both mentally and physically, but he started seeing some improvement after the sixth session. They worked on engaging and strengthening bigger muscles, controlling bodily movements, and perfecting his posture with the instrument.<sup>3</sup> The physical therapist always encouraged him to enjoy the retraining with a positive mindset, and asked him to never push himself or overdo any of the exercises. This advice allowed him to reduce his stress and persevere through this difficult period.

Meanwhile, he learned about a new treatment option near his hometown, but doing both treatments at once was impossible. Because the new treatment sounded quite effective (it claimed an eighty percent recovery rate), he decided to try it. This new (and expensive) approach, called “differential

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<sup>3</sup> These retraining exercises will be introduced in the appendix.

learning”, uses unorthodox methods to disrupt the existing neurological pathways, and essentially recalibrate the brain. Much of the treatment involves coordinating unfamiliar motor skills, to retrain how the brain controls the limbs. Before starting the treatment, patients must have their affected hand molded, for the creation of customized devices, such as splints and small weights to hang from the fingers. All of these tools serve to “confuse” the brain when the patient manipulates the affected fingers. This method also employs a “collateral task” to keep the brain adapting to various situations, and to prevent the brain from falling back into its habits. Some examples include applying different weights to each finger, and then lifting the fingers together, playing and talking simultaneously, constantly changing fingerings, or tapping contradictory rhythms with the feet while playing. The treatment is very interactive, and patients are encouraged to invent activities to confuse the brain. Our cellist found the training quite difficult, because like all classical musicians, he had spent years harnessing his physical awareness, and ignoring distractions. Ultimately, he felt that through allowing distractions and multitasking, he was able to shed his tension and anxiety.

He has been in treatment since August 2019, and he feels much more confident now when playing in front of others. He has not taken any pharmaceutical treatments (such as Botox injection, or Trihexyphenidyl) to alleviate his dystonic symptoms. Except for a vague discomfort when playing certain patterns, his symptoms are under control, and not noticeable to a listener. As he has seen progressive improvements after four months of retraining, he highly recommends the “differential learning” approach.

Despite the difficulties of coping with FD, his attitude has changed for the better. He grew to prioritize the enjoyment of playing music, rather than perfection or competitiveness. He learned to value process, and not just results, through his experience with training. Though it is scary and depressing to face such an immense obstacle as FD, he recommends understanding the situation intellectually rather than emotionally, nurturing the mind and body, and finding the courage to approach the hardship head-on. To prevent injuries, he suggests having a regular practice schedule, and keeping ambition under control.

From interviewing the participants, I learned about their sincere love of music, and how desperate they were to play freely again. Recovery is a difficult journey with endless longing for something that may or may not be achievable. Everyone has a personal way of facing adversity, and the end result can differ depending on what approach one takes. I would like to emphasize that there are support, help, and solutions available. On a hopeful note, in face of all the adversity of FD, those who participated in the interviews have offered an optimistic view of the treatment process.

**D. Questionnaire + Follow-up Questions:**

1. What age did you start playing your instrument, and your age of onset of FD?
2. How did you find out that you have FD or how were you diagnosed with FD? What did you notice from the first symptoms? How bad was it?
3. How many hours were you used to practice before the diagnosis? How about after the diagnosis?
4. What do you think caused FD? What had changed around the time of the onset?
5. How long has it been since the diagnosis? Do you still have the symptoms? Are the symptoms better or worse now?
6. What are the changes after the diagnosis? Do the symptoms appear while not playing?
7. Do you still play your instrument? How do you feel about playing in public?
8. If your left hand is affected by FD, have you tried playing without bow? Does it feel different?
9. Did you develop any secondary pain from your dystonic symptoms?
10. Have you been helped with any medical sources or treatments? If so, please explain in detail. If not, have you developed your own exercises or routines to alleviate the symptoms?
11. Was finding resources and information about FD accessible and helpful? What is your opinion about current available resources?

12. Before developing FD, were you considering pursuing a career in musical performance? Has your outlook changed after the diagnosis?
13. What would you advise a peer? Any recommendations for them?
14. What is your opinion about preventive measures for this condition?

## CONCLUSION

Since retracing all of the memories from my own retraining period and research, I have come to realize how important it is to enjoy and have passion for the recovery process. In the most difficult and trying period of my life, I felt as if my vocation was continuously challenged and threatened. I had the possibility to give everything up, and had I done so, I am not sure what I would be doing now.

I auditioned for my doctoral degree when my symptoms were at their worst, and when I had no tools at my disposal to cope with FD. I, along with those involved in my education, had concerns about whether I could fulfill the heavy performance requirements of a doctoral performance degree at Indiana University, and furthermore if I could sustain my performing career. Ultimately, I chose to pursue my doctorate. I wanted to take advantage of the opportunities that the degree offers, not only to research and combat my own FD symptoms, but to share my findings in writing, as a resource for those who are in need. The purpose of this project is to present the readers with various options for rehabilitation, and to support them in finding their own approaches to cope with FD. The time I have dedicated to working on this project has been the most precious of my life. I was forced to take a deeper look into myself, and I feel as if I learned how to see what I could not before: instead of thinking about my physical obstacles as a misfortune, I found a new purpose in accepting and confronting the reality I faced. I feel very fortunate that I am still able to play the violin. Moreover, I truly feel reinvigorated with a new love for music.

While there is to this day no proven cure for FD, there is much hope for the afflicted. I hope that this project illuminates the extent of the research dedicated to the treatment of FD, and affirms that there are many possible therapies, exercises, and strategies available to anyone suffering from this condition.

## **APPENDIX: HANDBOOK OF EXERCISES**

This handbook provides various exercises for improving postural alignment and activating large muscle groups. These exercises are a collection of physical training methods that I learned from my physical therapists, my violin teacher, and my colleagues with focal dystonia. While some of the exercises are standard, and others target dystonic symptoms specifically, all of them support a balanced and stable violin position, and comfort and freedom in the affected hand. This handbook is designed for violinists, but the contents may be customized and applied to other string instruments.

Below, you will find four different types of exercises: stretching, strengthening, relaxing, and hand exercises. Even though the first three of these categories—stretching, strengthening, and relaxing—are important for physical fitness and injury prevention, musicians often skip them, and dive directly into their practicing. The same lack of care can also be harmful at the end of a practice session, when the muscles should be properly relaxed. Therefore, I have included these exercises in full, as to encourage the readers to draw upon them (e.g., to do one from each section daily) as an organized guide for retraining. Building large muscles around the lower back and shoulder blades may help mitigate any physical shock from playing for many hours. Finally, our body needs sufficient time to heal and relax from dynamic physical activities. At the end, I have included an extra exercise for visualization and improving finger sensation. Though it is less of physical exercise, I found it especially beneficial when recalling how my fingers had felt before the injury.

The list of exercises in this handbook follow no particular order, and can be added to any other exercise routine. In my case, I found that the best way to regain control of the affected finger was to practice these exercises every day (about forty-five minutes total). Since some exercises require a great deal of concentration, the time and number of repetitions can be adjusted to suit individual needs. Keep in mind that the quality of execution is more effective than the number of repetitions, so observe each movement with great care, especially during the hand exercises. These hand exercises are particularly



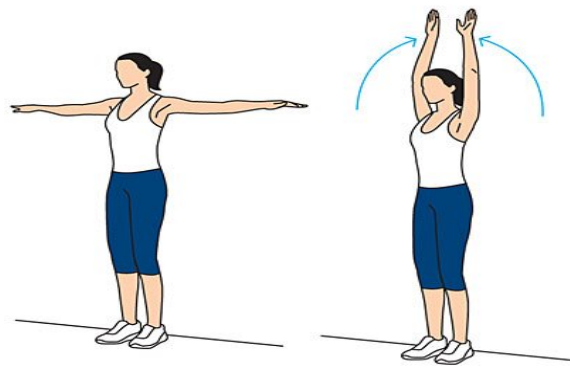
demanding, both mentally and physically, so approach the work with a positive mindset, and let yourself enjoy each movement; take frequent breaks to avoid mental and physical fatigue. Lastly, make sure to inhale and exhale deeply as you complete the exercises. Feel your chest cavity expand and collapse with each breath.

Not only did these exercises help me cope with FD, they enabled me to perform the violin again at a very high level.

## **A. Stretching**

### **A-1. Wall Angel**

Stand with your back against the wall and your arms at your sides. Use the scapulae (shoulder blades) to slowly lift both arms up to ninety degrees. Gradually lower the arms back to the sides, and repeat the motion ten times. (See Figure 15. below) If you want an extra stretch on biceps and triceps, bend your wrists to point your fingers up.



**Figure 15. Wall Angel**

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<sup>1</sup> “Three Basic Exercises for Energy,” Health, accessed October 13, 2020, <https://www.health.com/fitness/3-basic-exercises-for-energy>.

## A-2. Arm Circles

Now stand away from the wall, with the arms lifted at ninety degrees up (see Figure 16. below). Again using your scapulae, draw small circles with the heels of both hands (the lower palms). Circle ten times forward, and ten times backward.



**Figure 16. Arm Circles**

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<sup>2</sup> “Beginner Exercises to Strengthen and Tone Your Arms,” Shape, accessed October 13, 2020 <https://www.shape.com/fitness/tips/20-tips-get-toned-arms-faster>.

### A-3. Wall Angel in W-shape

Stand with your back against the wall. Bend your elbows to ninety degrees at shoulder height, with your hands up and palms out. While maintaining contact to the wall, slowly lift both arms over your head until straight. (See Figure 17. below) Push your shoulder blades up as you lift your arms. Observe where tension is created. Then return to the original position, and repeat ten times.



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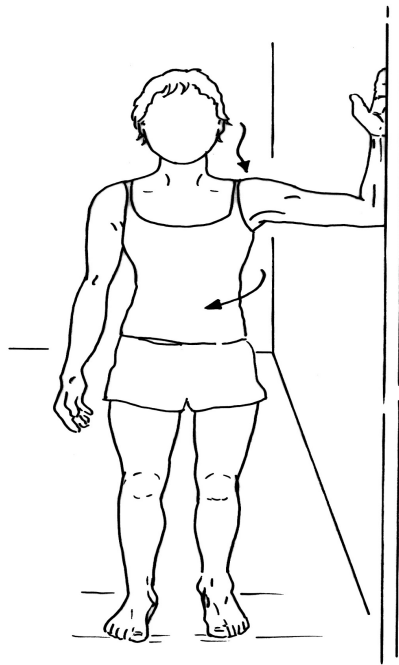
**Figure 17. Wall Angel in W-shape**

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<sup>3</sup> “Wall Slide,” Best Health Magazine, accessed October 14, 2020, <https://www.besthealthmag.ca/best-you/stretching/wall-slide/>.

#### A-4. Pectoralis Stretch

Stand in a doorway or at the corner of a wall with your arm flattened against the wall at a ninety-degree angle. (See Figure 18. below) Step forward so that your body is in front of your arm on the wall. Twist your body away from the raised arm to stretch the big muscle group around the chest. Feel how the shoulder blade is pressed tightly to the spine. Hold this position for twenty seconds, and then rest. Repeat three times on each side.



28(a)

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**Figure 18. Pectoralis Stretch**

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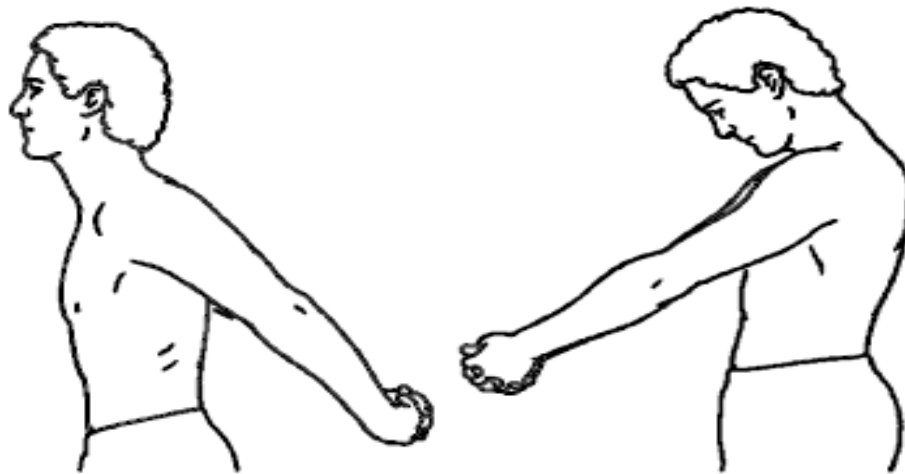
<sup>4</sup> “Pecs Doorway Stretch,” Pezcame, accessed October 14, 2020, <https://pezcame.com/cGVjcyBkb29yd2F5IHN0cmV0Y2g/>.

### A-5. Chest Bicep Stretch & Upper Thoracic Stretch

Clasp both hands behind your back and squeeze your shoulder blades together. Stretch your neck by letting your head fall back. Hold for five seconds, and then release.

Then clasp both hands in front of you with your fingers laced, palms together, and arms extended forward (see Figure 19. below). Bend your head down, allowing the shoulder blades to pull away from the spine.

Hold for five seconds and rest. Repeat three times on each side.



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**Figure 19. Chest Bicep Stretch (left) & Upper Thoracic Stretch (right)**

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<sup>5</sup> “Lower cervical upper thoracic stretch,” class connection, accessed October 14, 2020, [https://classconnection.s3.amazonaws.com/153/flashcards/958153/png/chest\\_bicep\\_stretch1332201059131-thumb400.png](https://classconnection.s3.amazonaws.com/153/flashcards/958153/png/chest_bicep_stretch1332201059131-thumb400.png).

#### **A-6. Levator Scapulae Exercise**

Wrap your right arm over your head and touch your left ear. Then try to smell your right armpit. (See Figure 20. below) Hold the gentle stretch for twenty seconds, then release. Repeat twice on each side.



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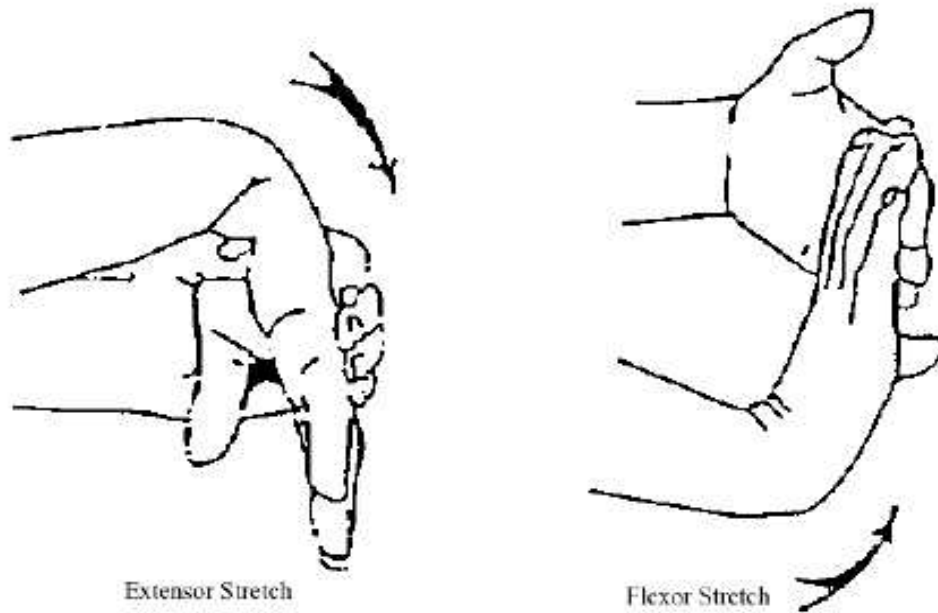
**Figure 20. Levator Scapulae Exercise**

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<sup>6</sup> “Physio Exercise for Levator Scapulae,” Colgan Osteopathy, accessed October 14, 2020, <https://osteopathy.colganosteo.com/exercises-for-levator-scapulae-muscle-pain-syndrome/>.

### A-7. Wrist Extensor & Flexor

Extend one of your arms forward with your palm facing down. Bend the wrist up (flexor) and down (extensor) using your other hand to increase the stretch. (See Figure 21. below) Hold each position for ten seconds and repeat three times.



**Figure 21. Wrist Extensor & Flexor**

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<sup>7</sup> “Wrist Extensor and Wrist Flexion Stretching,” Atrius Health Blog, accessed October 14, 2020, <https://blog.atrariushealth.org/2011/06/tennis-golf-and-elbow-pain/>.

## **B. Strengthening**

### **B-1. Pull-up Superman**

Lie down on your stomach with your arms extended forward, and lift your arms and chest off the ground. Then bending the elbows, pull the hands towards your shoulders making W-shape. Try to squeeze the lower back with lowering the arms. (See Figure 22. below) Repeat raising and lowering arms ten times. This exercise can be done in standing position as well.



**Figure 22. Pull-up Superman**

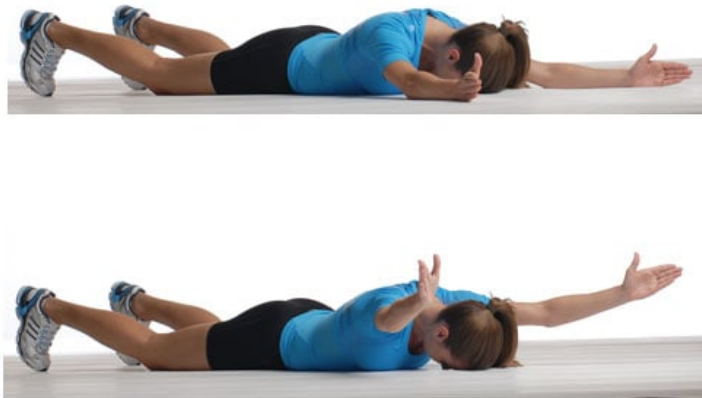
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<sup>8</sup> “Superman Lat Pull,” Nourish Move Love, accessed October 14, 2020, <https://www.nourishmoveandlove.com/back-exercises-for-women/>.



## **B-2. Y-floor Superman**

Again, start with the chest and arms off the ground, raise and lower your arms vertically. (See Figure 23. below). When your arms are raised, stretch the chest and squeeze the spine. Repeat ten times.



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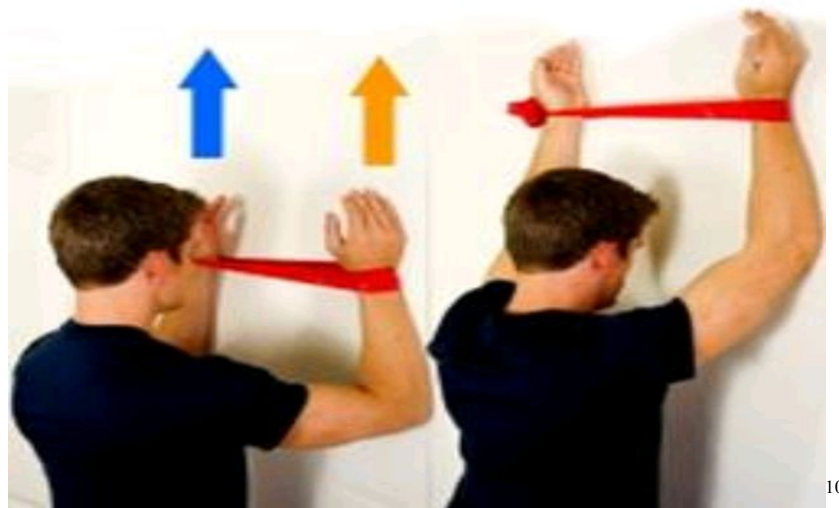
**Figure 23. Y-floor Superman**

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<sup>9</sup> “Y’s on the Floor,” Popsugar Fitness, accessed October 14, 2020, <https://www.popsugar.com/fitness/photo-gallery/7102627/image/7102636/Y-Floor>.

### B-3. Serratus Wall Slide

Place a Thera-band loop around both wrists, with your palms facing each other and your fingers up. (See Figure 24. below) Gently spread your wrists to shoulder-width. Starting with your elbows bent at ninety degrees, slowly move your hands up and down in front of you. Repeat ten times.



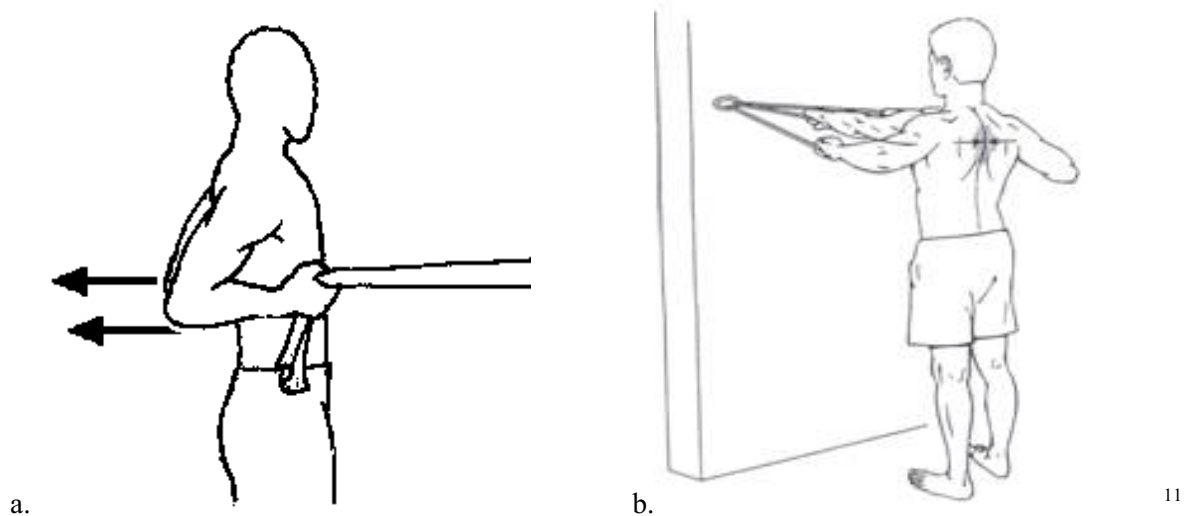
**Figure 24. Serratus Wall Slide**

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<sup>10</sup> “How to do: Serratus Anterior Wall Slide,” Skimble, accessed October 14, 2020, <https://www.skimble.com/exercises/42526-serratus-anterior-wall-slide-how-to-do-exercise>.

#### B-4. Shoulder Retraction on Three Levels

a. Place a Thera-band around a solid object (pillar or pole) at waist height. Grab both ends of the band with your hands in front of your body. Stand straight, and pull your hands towards your waist, squeezing both shoulder blades together. (See Figure 25-a. below) This low rowing movement promotes the activation of both shoulder blades.



**Figure 25. Shoulder Retraction: a. waist level, and b. shoulder level**

b. Move the band to shoulder height. Pull your hands towards your shoulders to activate the muscles around the upper shoulders. (See Figure 25-b. above)

c. Move the band above your head and repeat the same movements. This will exercise the shoulder blades and upper shoulder muscle groups. Pull the band for three seconds, and repeat ten times on each level.

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<sup>11</sup> “Shoulder Retraction,” onsmnd, accessed October 14, 2020, <https://onsmd.com/spine/common-spine-exercises/>.

“GH band scap row,” chiropractor.co.za, accessed October 14, 2020, <https://www.chiropractor.co.za/stable-shoulder/gh-band-scap-row/>.

### **B-5. Shoulder External Rotation**

Tie one end of the Thera-band at waist-height around an immovable object. Stand with one side facing the object. Hold the band with your opposite hand in a fist, fingers up. Bend your elbow to ninety degrees and tuck it into your side, so that your forearm is perpendicular to your body. As a challenge, you can pin a towel between your elbow and your side, and do not let it fall. Start with your forearm in front of you, and make sure there is some tension in the band. (See Figure 26. below) To exercise, pull the band away from the object by rotating your forearm outward until it is in line with your body, and then slowly return to the starting position. Repeat ten times with each hand. This exercise targets the muscles around the deltoids.



**Figure 26. Shoulder External Rotation**

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<sup>12</sup> “Shoulder Strengthening Exercises,” PTA Exercise Database, accessed October 14, 2020, <http://slccpta.weebly.com/shoulder-strengthening.html>.

### **B-6. Prone Shoulder Rows**

Lie on your stomach at the edge of a bed or a bench, with one of your arms hanging towards the floor. Hold a weight in your hand. (See Figure 27. below) Slowly pull the elbow up as if you were lifting a bucket towards your body, and then return to the relaxed position. Repeat ten times with each hand.



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**Figure 27. Prone Shoulder Rows**

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<sup>13</sup> “Prone Rows,” Dunsborough Physiotherapy Centre, accessed October 14, 2020, <http://www.dunsboroughphysio.com.au/physio-exercises.html>.

### B-7. Supine Scapular Protraction

Hold a light weight in each hand. Lie down on your back and raise one hand towards the ceiling at a time. (See Figure 28. below) Keep the elbow straight. Using your shoulder blades, push up one hand at a time. Repeat ten times on each side. This strengthens both the shoulder blades and the deltoids.

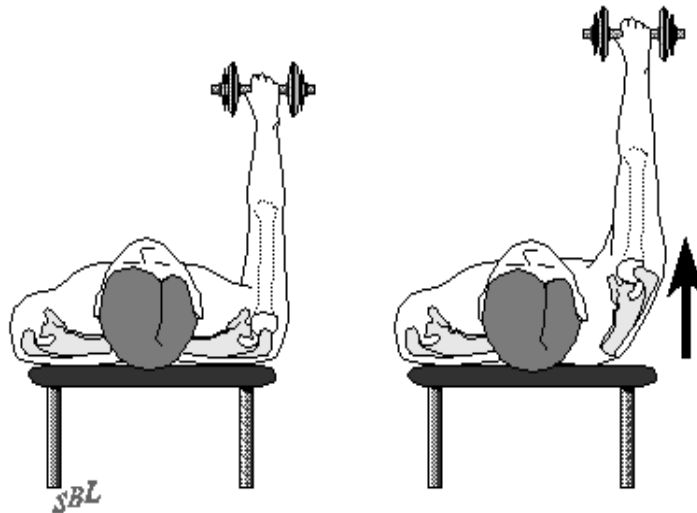


Figure 14-143

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**Figure 28. Supine Scapular Protraction**

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<sup>14</sup> “Part III: Scapular Muscle Exercises,” UW Medicine Orthopaedics and Sports Medicine, accessed October 14, 2020, <https://orthop.washington.edu/patient-care/articles/shoulder/home-exercises-for-the-unstable-shoulder.html>.

### **B-8. Bent-over Row**

In a standing position, align your feet with your shoulders and gently bend your knees. Let your back be at a diagonal but keep it straight. Hold weights in both hands and let your arms hang down with your knuckles facing away from you. (See Figure 29. below). Lift the weights by raising your elbows to shoulder level and squeezing the shoulder blades to the spine. Repeat ten times.



**Figure 29. Bent-over Row**

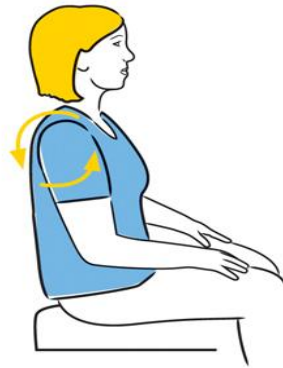
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<sup>15</sup> “Bent-Over Row,” Popsugar fitness, accessed October 14, 2020, <https://www.popsugar.com/fitness/photo-gallery/35176832/image/35176856/Bent-Over-Row>.

## C. Relaxing

### C-1. Shoulder Rolls

Standing or sitting, let your arms hang down. Use your shoulder blades to circle your shoulders forward and backwards. (See Figure 30. below) Do ten circles in each direction.

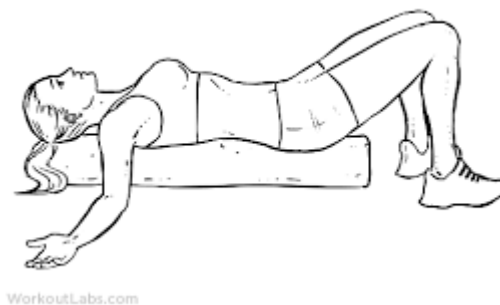


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**Figure 30. Shoulder Rolls**

### C-2. Foam Roller Chest Opener

While lying on your back, place a pillow or a foam roller under the ribcage to feel a gentle stretch in your chest. Rest both arms on the floor. (See Figure 31. below) Inhale and exhale ten times in this position.



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**Figure 31. Foam Roller Chest Opener**

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<sup>16</sup> “Shoulder Rolls,” Cancer Council New South Wales, accessed October 14, 2020, <https://www.cancercouncil.com.au/cancer-information/living-well/exercise-cancer/arm-shoulder-exercises-after-surgery/level-one-exercises/>.

<sup>17</sup> “Foam Roller Chest Opener Stretch,” WorkoutLabs, accessed October 14, 2020, <https://workoutlabs.com/exercise-guide/foam-roller-chest-opener-stretch/>.



### **C-3. Child Pose**

Kneel down with the tops of your feet on the floor. Reach your arms forward and press them to the ground. As you exhale, push your shoulders down to elongate your body, and hold for ten seconds. (See Figure 32. below)



**Figure 32. Child Pose**

### **C-4. Neck Re-alignment**

Stand up straight in front of a mirror and lift both hands above your head. Touch your fingers together to make an O-shape with your arms. Elongate your spine, while relaxing your neck and shoulders. Use the mirror to correct any asymmetric posture. This exercise aligns your neck and spine.

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<sup>18</sup> “Child’s Pose,” Life Brate, accessed October 14, 2020, <https://www.lifebrate.com/15-minute-morning-yoga-routine/>.

### **C-5. Constructive Rest**

Lie down and feel each part of your back sinking into the mat. Find the most peaceful position for all of your body. (See Figure 33. below) Your legs can be bent or in any resting position. Your hands can be either on your stomach or on the floor. Close your eyes and breathe deeply, feeling your stomach rise and flatten with each breath. Stay like this for two to three minutes. Slowly roll to the side and stand up. Take a slow walk for a minute until you feel balanced.



**Figure 33. Constructive Rest**

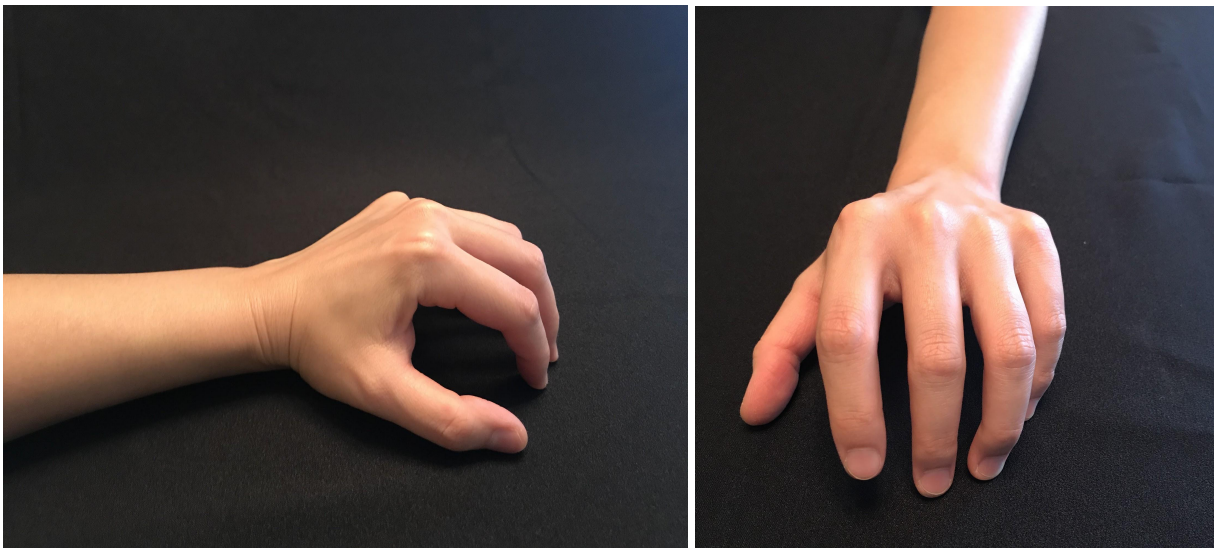
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<sup>19</sup> “The Semi-Supine Position,” The Dimon Institute, accessed October 14, 2020, <https://www.dimoninstitute.org/single-post/2018/05/24/The-Dev-Mo-Project-Semi-Supine-Position-Part-1>.

## **D. Hand Exercises: Strengthen Your Hand and Fingers**

### **D-1. Convex Palm Exercise**

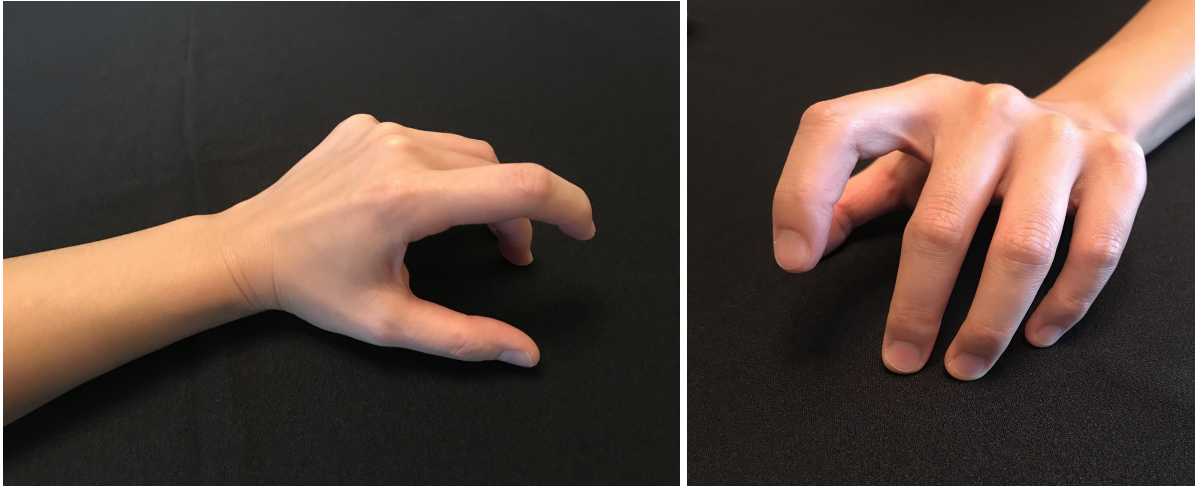
On a flat surface, rest the forearm of the affected hand with the palm-side down. Gradually create a dome shape with your hands by going up on your fingertips. Let each knuckle and joint be convex, and feel your bones spread apart. (See Figure 34. below) Hold this shape for three seconds and flatten again. Repeat this motion for five times.



**Figure 34. Convex Palm Exercise**

## **D-2. Knuckle Push-ups**

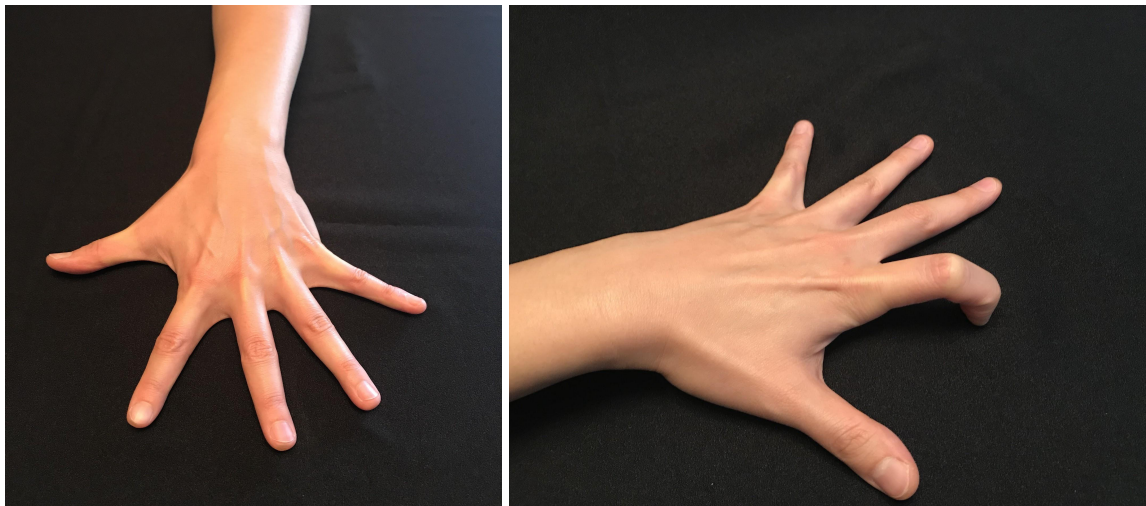
With the same handshape as in Figure 34, slowly raise and lower one finger at a time, letting the fingers feel heavy. (See Figure 35. below) Use the largest muscle, from your dorsal hand behind the knuckle, to lift the finger. Observe the movement very carefully and repeat five times on each finger.



**Figure 35. Knuckle Push-ups**

### **D-3. Retracting Finger Exercise**

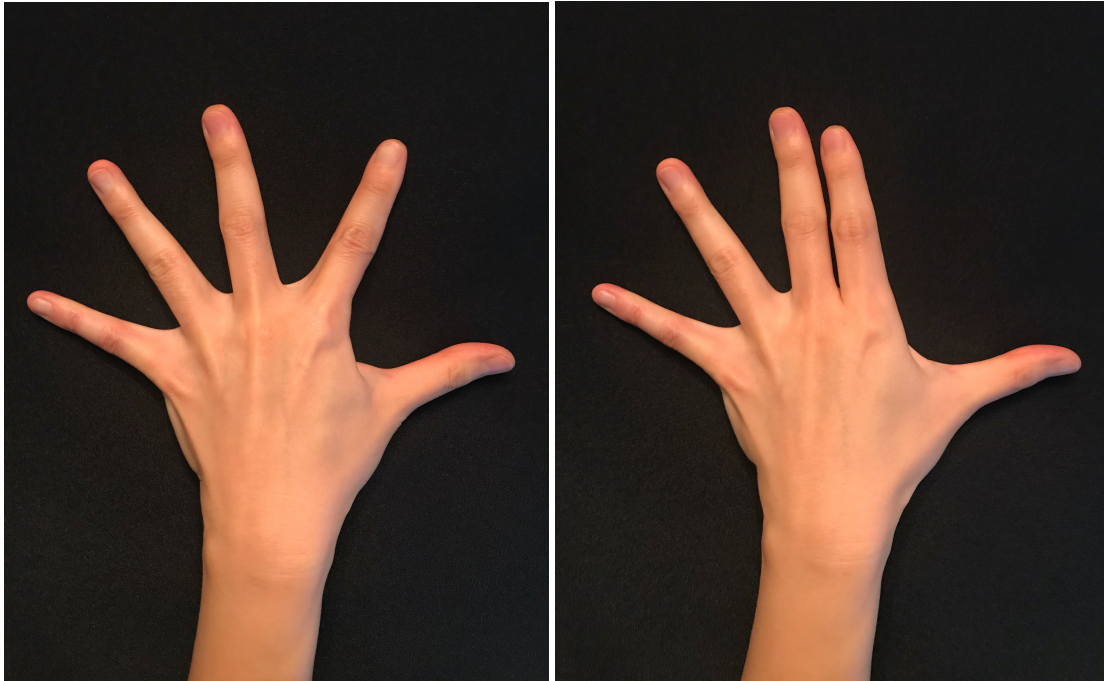
Place the palm of the hand on a surface and spread the fingers wide. Feel that muscles and bones of the dorsal hand are separated. Keeping your palm flat, slowly drag one finger on its tip towards your hand. The finger should reach an arch-shape. Then gradually return to the initial resting position. (See Figure 36. below) Feel that you are using the muscle of the dorsal hand to fold your joints. The movement of the finger should be so slow that you can feel each gradation of the motion. Repeat ten times for each finger. Try this exercise on your instrument as well. Pull back each joint slowly and deliberately. Try to resist any involuntary movement or trembling.



**Figure 36. Retracting Finger Exercise**

#### **D-4. Finger Wiper Exercise**

Spread your fingers wide on a surface as in Figure 37. Keeping the hand stable, shift one finger from side to side, using your full range of motion. Repeat the movement five times for each finger.



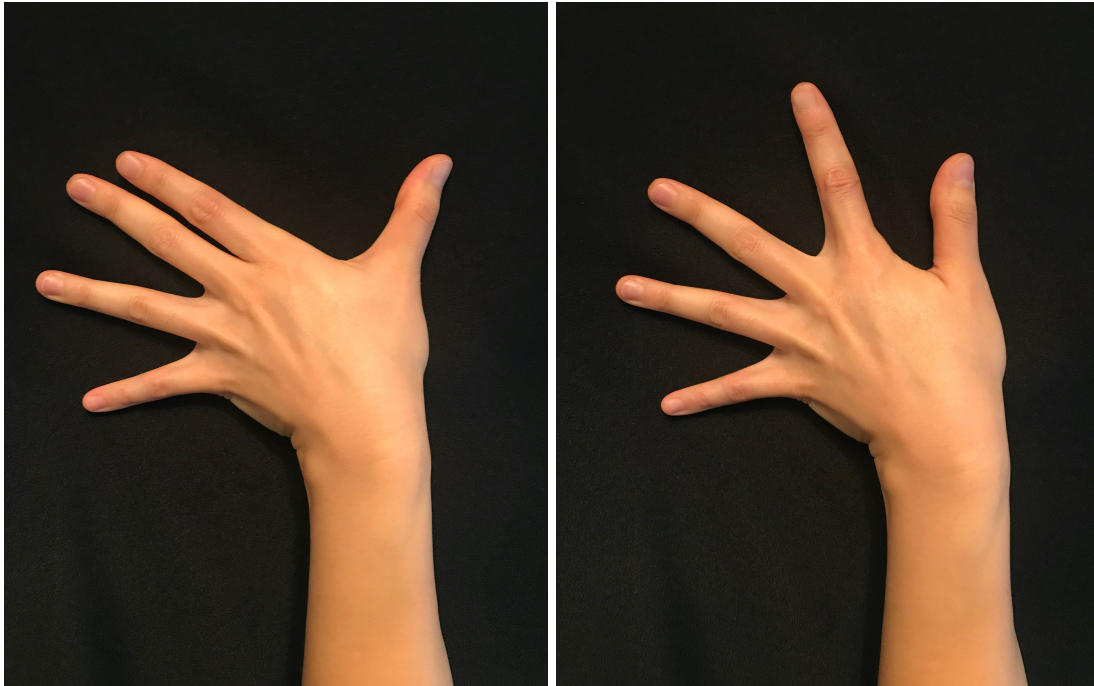
**Figure 37. Finger Wiper Exercise**



#### **D-5. Tilted Finger Wiper Exercise**

Do the same hand exercise as in Figure 37, but with a tilted wrist. Keeping your forearm and hand flat on the surface, bend your wrist so that your hand is angled away from your body. (See Figure 38. below)

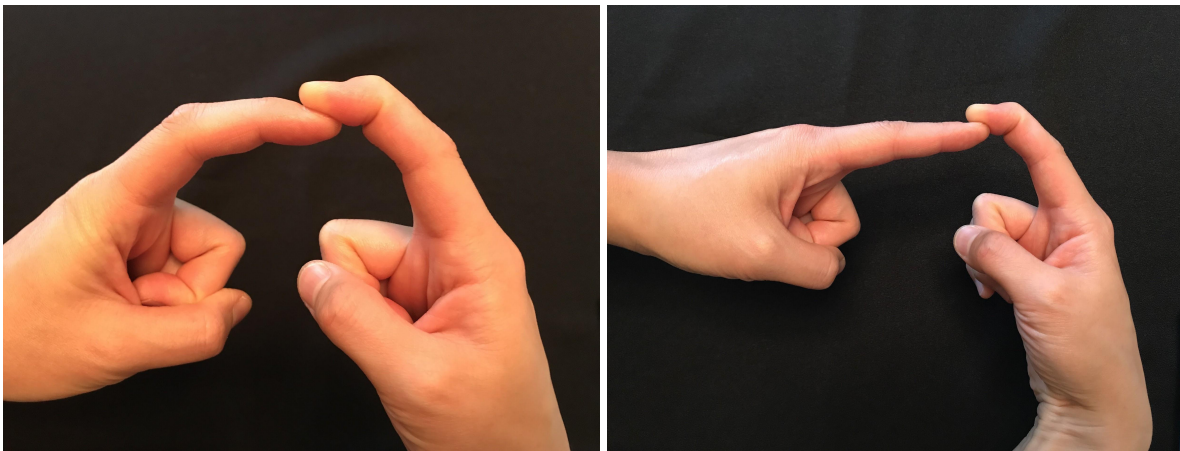
Complete the exercise from this starting position. Repeat five times with each finger.



**Figure 38. Tilted Finger Wiper Exercise**

#### **D-6. Fingertip Push & Pull-ups**

Hold up both hands in front of you. Rest a finger from your unaffected hand on top of the affected finger, so that the fingertips are stacked. Use the affected finger to slowly lift the unaffected finger until the affected is straight. (See Figure 39. below) Keeping the affected finger straight, change the finger order so that the unaffected is on the bottom. Slowly push down the unaffected finger, until the affected is curled into a playing position. Repeat this exercise five times.



**Figure 39. Fingertip Push & Pull-ups**



### D-7. G-D-A-E A-D-G Exercise

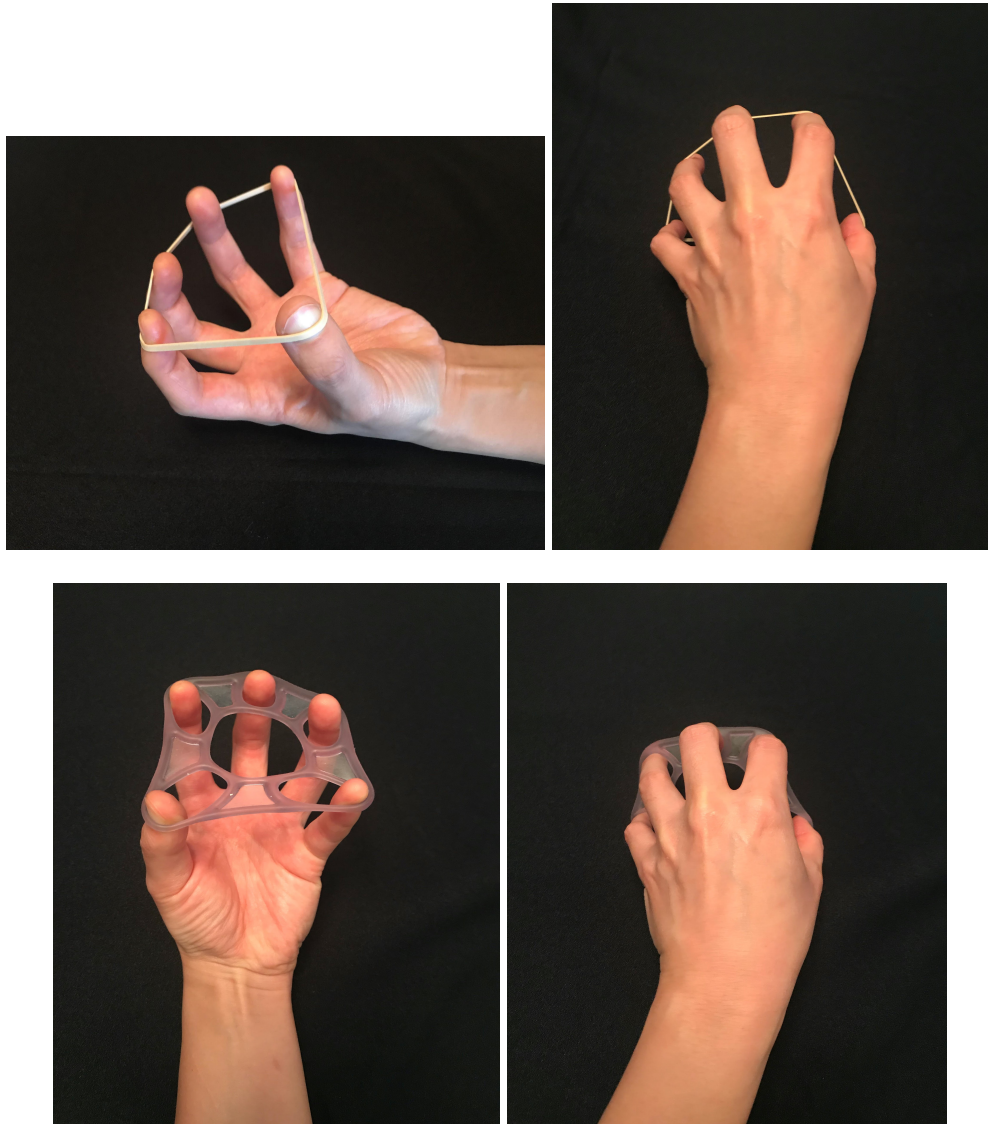
Take your instrument and place each finger on each string respectively. For example, on the violin, place the little finger on the G string, the ring finger on D string, the middle finger on A string, and the index finger on E string. Slowly lift the affected finger off the string and gently put it back down. (See Figure 40-a. below) Always move slowly to avoid trembling and involuntary movements from the other fingers. Then reverse the finger order and do the same exercise (as Figure 40-b.). Repeat ten times in each position. This exercise helps to regain individual control of the affected finger.



Figure 40. G-D-A-E A-D-G Exercise

#### **D-8. Rubber Band Extension Exercise**

Place a rubber band around the fingertips of your affected hand (see Figure 41. below). Feel the knuckles expand as you pull the fingers away from each other. Make sure the knuckles and joints are convex. This exercise will work on strengthening and separating the muscles between the finger bones to achieve independent movement. Hold for ten seconds and rest.



**Figure 41. Rubber Band Extension Exercise**

### D-9. Extended Palm Exercise

Rest your hand on a surface with your palm facing down (see Figure 42-a. below). Leaving your forearm on a surface, lift your hand fifteen degrees. (Figure 42-b.) Tilt your hand slightly to the cubital side (slightly raise the thumb side) to create tension on the top of the inner forearm (radial). Make sure your little finger is not touching the surface (Figure 42-c.), and spread the knuckles wide to stretch the first and the fifth metacarpals (the palm muscles connected to the thumb and the little finger, see Figure 42-d.). The tension in the metacarpals strengthens the frame of the hand to support finger movements. Hold for ten seconds and rest.



**Figure 42. Extended Palm Exercise**



#### **D-10. O-shaped Hand Exercise**

Start with your forearm and the dorsal hand on a surface with the palm facing up. Figuratively, glue the center of your dorsal hand to the surface, and press down your palm. Make an O-shape with the thumb and each other finger, while keeping the base metacarpals of each finger on the surface. Slowly, touch the tip of one finger to the tip of the thumb, feeling resistance in the palm, and then return to your original position. (See Figure 43.) Repeat this exercise five times for all four fingers. This exercise strengthens the inner muscles of the hand.

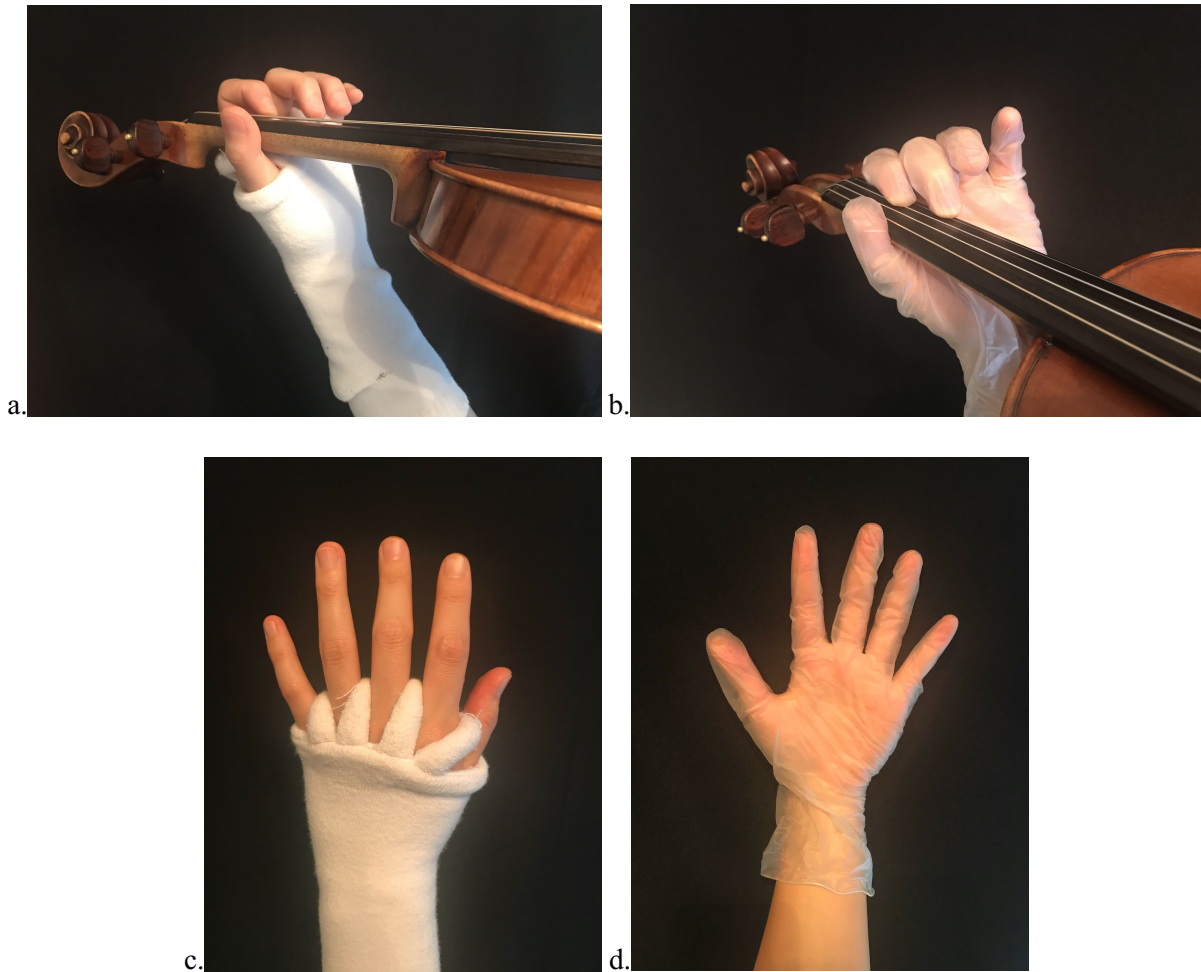


**Figure 43. O-shaped Hand Exercise**

### **D-11. Glove Effect (Complimentary Recommendation)**

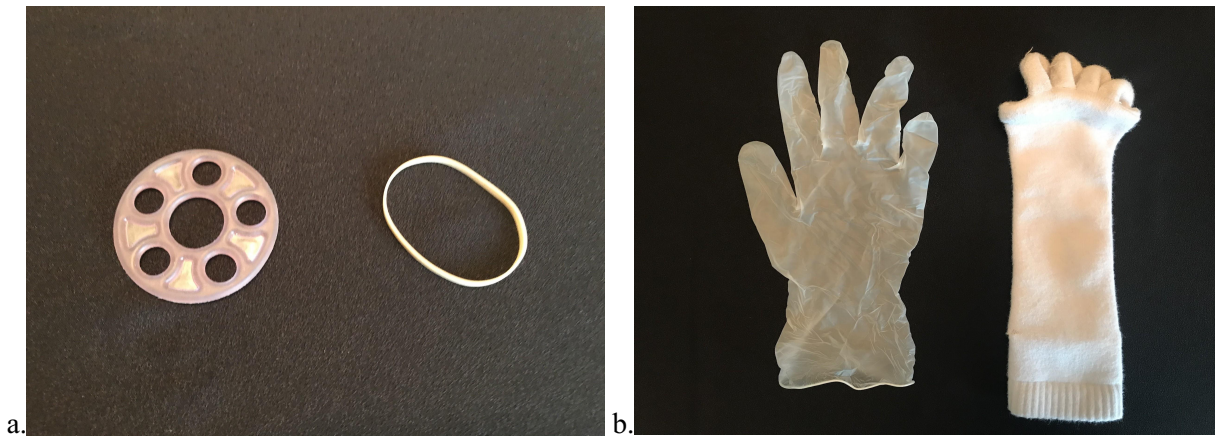
Gloves can help you regain different sensations in your hand. Thick, fingerless gloves (that separate the bases of the fingers) can support the independence of motion of each finger. (see Figure 44-a. & c. below)

Thin, latex gloves are slightly sticky, and can magnify the feeling of the string. (see Figure 44-b. & d. below)



**Figure 44. A Fingerless Glove (a & c) and a Latex Glove (b & d)**

## D-12. Supplies Used in The Hand Exercises



**Figure 45. Supplies: a. Finger “Thera” band and rubber band, and b. gloves (latex and no fingertips)**

## E. Visualization Practice: Touch and Go

**E-1.** Close your eyes and clear your mind. Get rid of any anxiety. Once the mind is peaceful, pick up your instrument, but if you feel any negative thoughts, put your instrument down and clear your mind again.

This practice will train you to avoid any negative feelings about the instrument. Once you have successfully cleared your mind, hold the instrument in playing posture. Repeat this exercise several times, until you feel no anxiety when holding your instrument.

**E-2.** With the calm mindset, feel the strings very briefly with any part of your hand so that you can focus on the sensation of touching. Once you have touched the strings, take off your hands from the strings and remember how your hands sensed the strings. Try to describe the feeling in detail.

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