AN ANNOTATED BIBLIOGRAPHY OF CURRENT RESEARCH IN THE FIELD OF
THE MEDICAL PROBLEMS OF TRUMPET PLAYING

D.M.A. Document

Presented in Partial Fulfillment of the Requirements for the Degree
Doctor of Musical Arts in the Graduate School at The Ohio State University

By

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ABSTRACT

The very nature of the lifestyle of professional trumpet players is conducive to the occasional medical problem. The life-hours of diligent practice and performance that make a performer capable of musical expression on the trumpet also can cause a host of overuse and repetitive stress ailments. Other medical problems can arise through no fault of the performer or lack of technique, such as the brain disease Task-Specific Focal Dystonia. Ailments like these fall into several large categories and have been individually researched by medical professionals. Articles concerning this narrow field of research are typically published in their respective medical journals, such as the Journal of Applied Physiology. Articles whose research is pertinent to trumpet or horn, the most similar brass instruments with regard to pitch range, resistance and the intrathoracic pressures generated, are often then presented in the instruments’ respective journals, ITG Journal and The Horn Call. Most articles about the medical problems affecting trumpet players are not published in scholarly music journals such as these, rather, are found in health science publications. Herein lies the problem for both musician and doctor; the wealth of new information is not effectively available for dissemination across fields. The purpose of this exhaustive literature search was to produce a single document that collects and annotates current and pertinent research in
the field of medical problems of the trumpet player and make it available for the trumpet playing community, music educators, conductors and physicians. The bibliography is divided into sections by topic and entries include a bibliography and abstract. Whenever possible, the abstracts by the original authors are used, as they are the experts on their own research.
Affectionately dedicated to my fiancée, Cristina Santelli
ACKNOWLEDGMENTS

This document would not be possible without the encouragement, love and support from many. First, I genuinely wish to thank my Lord and Savior, Jesus Christ, for the talent and opportunities He has given me. It is my continued prayer to be a faithful steward of the tremendous gifts of my educational and musical opportunities.

I owe an enormous debt of gratitude to my family. I am extremely grateful to my parents, Roger and Sue Wade, for their lifelong support of my musical career and music education. You always believe in me and encourage me to pursue my dreams. I also thank you for your help in proofing this document.

I am also very thankful to my sister and brother-in-law, Dana and Matt Black, my roommates and best friends. Thanks for tolerating the late night practice sessions and for making me, my fiancée, my students, and of course, The Beast (my dog), so welcome in your home.

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sincere gratitude to my first trumpet teacher, Dr. Larry Griffin. I would also like to acknowledge the tremendous education I received from my late piano professor and friend, Jo Ann Fuller Hopper. I am likewise very grateful to the following inspirational teachers: my high school piano teacher, Ms. Joann Jones, for making me *actually* learn how to read music; to my first high school band director, Colleen Kent, for calling me in the summer before ninth grade and convincing me to continue in band after I had dropped it; and to Bill Thissen, the band director my senior year of high school, who continued to inspire excellence.

I would also like to publicly thank my private students for their support of my career and education. Thank you for being so flexible with my hectic schedule and for all the Tim Horton’s and Starbucks! You certainly provided much more than grocery and rent money. I am blessed by your friendship and moved by your own musical accomplishments.

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**DISCOGRAPHY**


[Principal Trumpet.]


[All original pieces arranged and co-written by Mark Wade. Hammered dulcimer and guitar.]


[All traditional pieces arranged and studio engineered by Mark Wade. Mountain dulcimer, guitar, and keyboards.]


[All classical pieces were transcribed for hammered dulcimer (and trumpet, track 13), and performed by Mark Wade.]


[All pieces produced and studio engineered by Mark Wade. MIDI sequencing, guitar.]


[All traditional pieces arranged and studio engineered by Mark Wade. Mountain dulcimer, guitar, and keyboards.]


[All pieces arranged by Mark Wade and Alex De Pue. Hammered dulcimer and electric bass.]


[All pieces arranged by Mark Kreis and Mark Wade. Hammered dulcimer.]

[Hammered dulcimer.]


[Hammered dulcimer.]


[All pieces arranged by Mark Kreis and Mark Wade. Hammered dulcimer, guitar and mountain dulcimer.]


[All pieces arranged by Mark Wade. Hammered dulcimer, guitar and keyboards.]

**FIELDS OF STUDY**

Major Field: Music

Area of Emphasis: Trumpet Performance
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CHAPTER 1

INTRODUCTION

The pressures of the competitive market in the realm of professional musicians place extreme demands on contemporary trumpet players both physically and psychologically. The demand for perfection has the potential to exhaust the physical limits of instrumentalists with countless hours of practice and rehearsals. The popular life adage of “working harder” to achieve the next level of success translates to trumpet players as “practicing harder.” For many trumpet players, this means practicing for an unhealthy length of time without rest, and with an unhealthy amount of pressure on the lips. It is no wonder that dozens of self-inflicted medical problems affect trumpet players.

The branch of medical research for instrumentalists and performing artists is relatively young and slow in its development. The earliest record of the diagnosis of musicians’ disorders was in 1713 by Bernardino Ramazzini (1633-1714), the father of the study of occupational illnesses. In his pioneering oeuvre, *De morbis artificum diatribae* [Diseases of Workers], first published in 1700 and later revised in 1713, Ramazzini lists

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the occupational dangers of fifty-two vocations.\textsuperscript{2} Despite this early 18\textsuperscript{th} century publication date, this field of study remained quite young in its development. The next major diagnosis pertaining to trumpet players was that of focal dystonia, which British neurologist, Sir William Richard Gowers (1845-1915) discovered in 1888.\textsuperscript{3} Even though this instance was merely the recognition of “writer’s cramp” (mogigraphia), this disorder is a hand manifestation of the same type of focal dystonia that can affect musicians including trumpet players.

Aside from recognizing the existence of the occupational hazards of musicians, this field was essentially left dormant until the latter twentieth century, which witnessed a steadily developing specialization in musicians’ health issues. The first journal devoted to the linking of music and medical issues was \textit{Medical Problems of the Performing Artist}, founded in 1986. Further evidence of the growing interest in this research was the 1991 French publication of the second major journal in this field, \textit{Médecine des arts: Approche médicale et scientifique des pratiques artistiques}.

Due to the close publication dates of these two major journals, the scope of this bibliography was chosen in an attempt to deliver a comprehensive survey of the significant literature from all journal, book and dissertation literature pertaining to the medical problems of trumpet players from 1986 to the present, with selective coverage of older significant publications for historical perspective. An additional benefit to narrowing the scope for this research to the publication date of the older of the two major journals in this field is the assurance that the research presented here is the most current available.

\textsuperscript{2} http://www.whonamedit.com/doctor.cfm/428.html, accessed 5/12/08.
Fortunately, this field of research continues to grow in an ongoing effort to understand the nature of these often mysterious injuries and to provide adequate treatment. Only recently have medical problems of the eye, for example, been attributed to trumpet playing. The nervous disorder, focal dystonia, which ends the careers of musicians, is still without cure or adequate prevention. Research in coping strategies during and after orthodontia is surprisingly lacking. Studies are also scarce in prevention, practical treatments and rehabilitation for musicians afflicted with certain ailments, such as a wandering atrial pacemaker.

Even though the scope of the medical problems of trumpet players from 1986 to present is a narrow field, there are several groups of common disorders. The most common injuries are as follows: hearing loss, nervous disorders, orofacial disorders and overuse syndrome, musculoskeletal injuries and vision problems. For convenience, these aforementioned categories make up the subdivisions of this bibliography. In addition, the following bibliography includes selected scholarly research that reveals general information about the anatomical and physiological processes involved in trumpet playing, as this field of study may explain and serve as a foundation for understanding more specific technical articles within each medical problem. Also included is an additional subcategory for sources that discuss more than one specific problem.

In further refining the scope of this project, I first had to consider the term “medical problem.” The first distinction in this survey is that of physical medical problems only, rather than psychological problems with physical manifestations. There

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are many physical conditions in trumpet performance that can cripple one’s playing without being a physical medical problem, (e.g., stage fright, facial perspiration or dry mouth). There are even examples of certain common musical and physical symptoms that are very real, which can be diagnosed in two very different ways: one medically and one psychologically. A quiver in the trumpet tone caused by stage fright is very similar in sound and appearance to that of focal dystonia (a nervous disorder wherein muscles or muscle groups contract involuntarily in rapid succession); yet only the latter is a medical problem in the physical sense of the word. Hence, this survey would only collect research on quivers in tone produced by a breakdown of the physical mechanism.

The second question in considering the term “medical problem” is “for whom is this a problem?” Many of the conditions studied are only problematic in the area of trumpet or brass performance but have no impact on the quality of the patient’s life. Most people commonly associate the term “medical problem” with medical conditions, such as a torn rotator cuff, which can impair the quality of the patient’s life by impacting the ability to sleep, work or play. While some medical problems collected in this research impact multiple aspects of a performer’s life in this manner, such as Temporomandibular Joint Disorder (TMJ), many other injuries only present themselves when playing the trumpet. A double buzz in one’s trumpet sound presumably caused from over exertion may not be able to be detected in any physical or medical examination. The “problem” is only manifest in trumpet performance and is only a “problem” because the sound is undesirable to the performer. What lies behind the “problem” may not be considered problematic to anyone but the performer (or the audience).
When a trumpet player’s career is taken into consideration, the old adage, “if it hurts, don’t do it” is not often an option for musicians’ occupational injuries. Thus, many such “medical problems” of trumpet players and other professional musicians are considered problems only when they are detrimental to one’s performing career. Fortunately, caring physicians and scholarly researchers have published a wealth of information on these sensitive conditions because they understand that a working trumpet player cannot simply cease playing indefinitely.

In a similar way, focal dystonia affecting trumpet players is undetectable except in its “focalized” activity, such as in embouchure formation. This condition’s name means a task and anatomically specific (focal) neurological movement disorder (dystonia). Unlike a torn rotator cuff that would incessantly cause pain and discomfort, a focal dystonia does not cause bodily pain. Moreover, it is only a “medical problem” as this research defines it because it is a physical malfunction of the nervous system as it adversely affects a certain patient group: trumpet players. Concerning this particular medical condition, it would appear in any other aspect of the player’s life that there was no problem at all. One cannot see a dystonia in the embouchure, for example. It only becomes a “problem” in the focalized activity. Consequently, what is a problem to the performer is not necessarily a problem to non-musicians. When these conditions appear in instrumentalists and careers are at stake they indeed become problems! This research seeks to find the physiological causes behind the physical symptoms that manifest themselves in trumpet performance, as well as their prevalence, prevention, treatments and cures.
One difficulty in this area of research is the inability of many musicians to look beyond the musical problems heard in their playing, to see the underlying physiological illness at work. Musicians tend to sense these symptoms in musical terms and respond by practicing even harder to try to achieve the desired musical result. It seems counterintuitive to many musicians that the fastest way to regain the desired musical result in the case of many over-use injuries is actually to practice less and rest!\(^6\) This situation may be further hindered by the patient’s difficulty in communicating the problem to the doctor in non-musical terms or in his inability to produce the symptom on demand, as in the case of laryngoceles (i.e., herniation of the larynx). The best data are collected when medical expertise and ongoing, succinct communication between doctor and musician are combined.

This research surveys the hazards that the countless hours of practicing and performing place on professional trumpet players and investigates the treatment, prevention, and prevalence of physical medical problems associated with modern instruments and players. Although the focus of the present study is specifically injuries of trumpeters, the bibliography also includes scholarly research done on a related brass instrument when the affected risk potentially overlaps into trumpet playing.

To that end, there is pleasingly an abundance of content-specific articles on musicians’ injuries. As mentioned previously, a very helpful source for this research has been the journal, *Medical Problems of Performing Artists*. The articles in this journal typically focus on specific ailments for specific instruments. Brass-specific articles for the two high-resistance brass instruments, trumpet and horn, have respective journals

(The Journal of the International Trumpet Guild and The Horn Call) that also contain a variety of scholarly articles on wellness. In addition, there are many books available on the subject of general musicians’ injuries. This investigation extracts from those books articles and chapters that deal specifically with trumpet playing or general musicians’ injuries that affect trumpet players in addition to other instrumental musicians, (e.g., tendonitis and carpal tunnel disorder).

The literature collected falls into two basic categories: comprehensive studies on musicians’ injuries discussing the nature, cause (etiology) or treatment of a particular disorder, and prevalence studies (epidemiology). The first large body of research examines the nature of a particular medical problem of instrumentalists: both heterogeneously among musicians and homogeneously to trumpet players. These studies often present information on medical conditions that affect a wider population to which the trumpet player belongs. For instance, carpal tunnel syndrome falls into this category because it affects many instrumentalists including, but not limited to trumpet players. In short, studies of this sort examine medical problems that affect trumpet players in addition to many other instrumentalists and even some non-musician groups. For the purposes of this study, research about disorders that do not explicitly affect brass players was not included. Rather, through the specific database search methodology employed, this survey collects data on these conditions (e.g., tendonitis) only as they apply to trumpet players. Some research in this group also addresses effective treatments. Others define the current state of research.

While the aforementioned research explains the nature or treatment of particular disorders, the second body of studies contributing to this research consists of the
epidemiology for common disorders. Literature in this category seeks to find the occurrence of a particular disorder, such as hearing loss. While there are several medical concerns that may present themselves in trumpet playing, it is interesting to see their prevalence recorded in this literature search. For the most part, these disorders only affect a small percentage of trumpet players within an already narrow population of trumpet players that play many hours per day and typically play more demanding music than the amateur trumpet player. Epidemiological studies of this type typically delineate occurrences of disorders according to the following variables: gender, age, number of hours played daily/weekly, range played on the trumpet (e.g., big band lead trumpet playing), percent of occurrence in other brass musicians, percent of occurrence among other instrumentalists, formal training and percentage of occurrence in non-musicians.

In regard to the abstracts themselves, there are two general literary styles of writing annotations: descriptive and declarative. In the descriptive style, the abstract lists what the article is about in general terms. For instance, a typical medical journal’s abstract might say, “Findings on trumpet playing and heart arrhythmia are presented.” This style is often useful for summarizing entire books or lengthy articles or chapters. Unfortunately, they are often composed in incomplete sentences and in the passive voice, as in the above illustration. This is the style generally used in the published databases used in the medical research field, such as MEDLINE.

The declarative style, however, differs in that these abstracts go beyond listing the topics presented within the article; it explicitly summarizes the conclusions of those topics. In the sample descriptive abstract above, the reader is left wondering about the nature of the “findings.” The abovementioned sample descriptive sentence could be
revised in the declarative style as follows: “Seventeen out of eighty-two subjects in this study demonstrated pre-ventricular contractions secondary to trumpet playing via prolonged, modified Valsalva maneuver.” In this revision, the reader is provided much more information: the who, what, when and why. In this way, the declarative style provides more information. Conversely, this style is less effective at summarizing large works for obvious reasons of length.

Whenever appropriate, annotations for this bibliography were written in the declarative style. The published abstract was almost always used if it was available, particularly if it was written by the author of the original source. There were a few instances where the published abstract was so vague due to the descriptive writing style that I wrote my own abstract in the declarative style. Likewise, there are sources included of a highly technical or medical nature for which I accepted a published descriptive style abstract and deferred to the known experts’ summaries.

Regardless of style, the purpose of abstracts is to summarize briefly the sources’ content for the reader. Most dissertations and scholarly journals include a published abstract at the beginning of the article. This allows the reader to determine in advance if the source warrants further reading. Likewise, the abstracts provided in this document are not intended to replace the original source. On the contrary, this annotated bibliography is intended to facilitate the research process for others.

Finally, there is a handful of articles in foreign languages that either had no English title provided, had an English title only with no title in the original language, or had a translated title with no English abstract. As stated above, whenever a published abstract was provided, I used it in an effort to present all available scholarship on the
subject. In instances in which no translated title or abstract exists, however, I chose either to compose a one sentence summary of the source, or to list the source in the bibliography with a statement of the unavailability of an English translation and the index record number for further inquiry. In this manner, all research is presented and the reader’s investigation of these topics is not hindered.

Readers may examine the sources in this bibliography in a number of ways: university libraries, public libraries and via the internet. One may obtain a guest account at university libraries if not already affiliated with the institution. With the following bibliographic citations, the source literature is generally available at these venues. In addition, public libraries provide inter-library loans for literature that is unavailable at the local branch. The literature database of life sciences and biomedical information, MEDLINE (Medical Literature Analysis and Retrieval System Online) is available on the internet via several free interfaces and is a valuable tool for further research.⁷

This annotated bibliography is intended to be shared as a resource for musicians and medical professionals alike with the intention of fostering awareness of the unhealthy pitfalls of trumpet playing, prompting better practice habits, promoting musician wellness, and providing insight into the prevention of these conditions. It is my hope that this body of research contributes to the betterment of trumpet players and music educators of all levels- whether performer, teacher, student or conductor.

CHAPTER 2

RESEARCH METHODS

The most successful research methodology for this comprehensive literature search began with a comprehensive exploration into the local, regional, and national library catalogues: The Ohio State University Library Catalogue, Ohio Link, and OCLC WorldCat. Following these keyword searches using a spreadsheet of applicable search terms, a second round of searches was conducted using the Library of Congress Subject Headings of the most relevant books: “Instrumentalists-Disease,” “Instrumentalists-Health and hygiene,” and “Musicians-Wounds and injuries.” The second phase of research involved article and dissertation keyword searches in the following indexes: Proquest Dissertations and Theses, IIMP (International Index to Music Periodicals), Music Index, RILM (Répertoire International de Littérature Musicale), and MEDLINE. Of particular value in this research is the literature database of life sciences and biomedical information, MEDLINE (Medical Literature Analysis and Retrieval System Online). MEDLINE is compiled by the U.S. National Library of Medicine and is available on the internet via several free interfaces, including PubMed.

I actually preempted my comprehensive literature search on the medical problems of trumpet playing by searching Proquest Dissertations and Theses to ensure that this
topic is truly unique and does not duplicate another scholar’s efforts. I was pleased to find a handful of helpful references that concentrate on an individual medical problem, such as T.M.J. Disorder, but no single document that dealt with the study or collection of abstracts for multiple medical issues.

For the research in Proquest *Dissertations and Theses*, I created a spreadsheet of search terms as follows:

<table>
<thead>
<tr>
<th>Citation and Abstract Field</th>
<th>Subject Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>“trumpet”</td>
<td>“music”</td>
</tr>
<tr>
<td>“trumpet*”</td>
<td>“music”</td>
</tr>
<tr>
<td>“trumpet*”</td>
<td>not “music”</td>
</tr>
<tr>
<td>“brass”</td>
<td>“music”</td>
</tr>
</tbody>
</table>

Table 2.1 Proquest *Dissertations and Theses* Search Terms

“Music” was used in the subject field for uncovering any music related research, as “music” is the universal subject heading (“subject name/code”). This ensured that the word “trumpet” would not retrieve results about the lifecycle of the “trumpet flower,” for instance. This important adaptation to my research only retrieved dissertations in which “trumpet” is found within a document in the subject field of “music.” When used with “and trumpet,” this search produced 842 results. Of these, four are relevant to my topic:


Bridges’ dissertation on bacterial flora in brass instruments exhausted this particular area of research. The Holland dissertation added new information on hearing loss in trumpet players. Similarly, Bailey’s dissertation on laryngeal activity may not be quoted directly in my discussion of medical problems, but will likely lead to a more complete understanding of the mechanism and shed light on disorders of the larynx in trumpet playing, such as velopharyngeal incompetence, or air escaping from the nose when under pressure. Briggs’ dissertation was included for its information on the demands of the lips during trumpet playing. Due to the unchanging approach to trumpet playing and technique in this regard, his dissertation is included despite its early publication date of 1968.

The next search cast a broader net by using truncation of the word, “trumpet,” (“trumpet*”) within the “citation and abstract” index in combination with “music.” This extracted 861 results. Among these, one additional entry on labial function in the embouchure proved helpful to show how the embouchure’s musculature functions. Like Bailey’s dissertation above, this is a valuable resource for gaining an understanding of the physiology of trumpet playing and helped clarify my understanding of medical terminology.

The next search in the spreadsheet system called for “music” in the subject heading using “and” plus “brass” in the “Citation and Abstract” field. This search yielded 600 entries and two relevant dissertations. These include:


The final search of Proquest Dissertations and Theses cast the widest search yet in an effort to exhaust all of the literature existing on trumpet injuries. In this search, the goal was to find all dissertations containing the word “trumpet*” (using truncation) anywhere within the citation or abstract. This caught dissertations from the Health Sciences field, for example, that used the word “trumpet.” Specifically, I entered “trumpet*” (using truncation) in the “Citation and Abstract” field. This retrieved 1016 hits and nine relevant dissertations. These dissertations were then individually examined to determine their contribution to this bibliography. Not surprisingly most results in this search were completely irrelevant. Typical results under this broad search would be “Trumpet Awards” or “Bush heralds a New Plan.” One helpful dissertation was found revealing new information on air and lip pressure:


This recent dissertation is useful as it reveals information about pressure, which is a contributing factor to many medical conditions of brass playing, including the following: TMJ disorder, velopharyngeal incompetence, and intraocular pressure.

Upon satisfaction of the originality of this research, next I searched The Ohio State University’s library catalogue for books written on the subject of trumpet/musician’s injuries. The search term spreadsheet used is the following:
This search began with pairing the keywords for the brass instrument(s) in the scope of this research with words retrieving medical problems, for instance, “trumpet*” and “injur*.” After searching for each key word in combination with the conditional keyword list, the end result was six germane books on focal dystonia and general musicians’ injuries. Upon the completion of the search spreadsheet, I expanded the search removing the conditional elements: trumpet, horn and brass. For example, I searched for “focal dystonia” as a keyword alone and found two additionally helpful books. One particularly significant book was *Medical Problems of the Instrumentalist Musician*, edited by Raoul Tubiana and Peter C. Amadio.
Continuing in the search spreadsheet methodology, the next search in the keyword index was intended to retrieve books on the next specific trumpet ailment: temporomandibular joint disorder. This retrieved nearly three hundred results. Since this bibliography is only concerned with how these conditions affect trumpet players, I refined the search to “temporomandibular and music*.” This produced two relevant books.

The next step in the research process was to continue searching The Ohio State University’s Library Catalogue using the Library of Congress subject headings (LCSH) of the most relevant books found, starting with “Instrumentalists-Diseases.” This search took me back to the original book from which I extracted the LCSH. Before examining the next LCSH, I searched under the author for this book, Raoul Tubiana, and found two of his eighteen books were helpful in the area of focal dystonia. Other relevant subject headings used were the following: “Instrumentalists-Health and Hygiene” (five results, though none specifically helpful to the trumpeter), “Musicians-Wounds and injuries” (two repeated results), and “Performing arts medicine” (four repeated results).

The state and national catalogues were searched using the same search term spreadsheet as in the above local library catalogue search. Ohiolink did not retrieve any original pertinent books employing the same search methodology. Using the same aforementioned LCSH subject headings, one relevant, though repeated, book was found under “Instrumentalists-diseases.” Two significant books were retrieved using “Instrumentalists- Health and Hygiene.” Likewise, two out of eleven books found proved to be within the scope of this research using “Musicians-Wounds and injuries.” The final
LCSH search retrieved fifty-three books, though the most salient books were repeated finds from other searches.

At the national level, this comprehensive literature search explored OCLC *WorldCat* using the same methodology: the identical search term spreadsheet followed by LCSH searches. This search provided two unique contributions to this bibliography. The second round of searches using the LCSH listed above brought about relevant, though repeated entries.

In an effort to search for related journal articles, a similar search strategy was employed in the HPP *Music Index Online* research database. The search spreadsheet included the following keywords: trumpet, brass, and horn in the list of keywords in Column A, as seen below:

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>trumpet</td>
<td>Injur</td>
</tr>
<tr>
<td>brass</td>
<td>Medic</td>
</tr>
<tr>
<td>horn</td>
<td>Disorder</td>
</tr>
<tr>
<td></td>
<td>TMJ</td>
</tr>
<tr>
<td></td>
<td>Temporomandibular</td>
</tr>
<tr>
<td></td>
<td>Satchmo’s (Syndrome)*</td>
</tr>
<tr>
<td></td>
<td>Brass poison</td>
</tr>
<tr>
<td></td>
<td>Allerg</td>
</tr>
<tr>
<td></td>
<td>Focal Dystonia</td>
</tr>
</tbody>
</table>

Table 2.3 - *Music Index* Search Terms

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* In searching for “Satchmo’s Syndrome,” I actually used the most distinctive term, “Satchmo’s.”
Music Index automatically includes truncation and all forms of words (injure, injuries, injurious) using the vendor, Harmony Park Press; thus, additional truncation was not needed. Column B included key words for medical problems or specific medical problems that are known to affect trumpet players using Boolean methodology. This research methodology produced 124 applicable sources.

Most surprising in this search was the lack of literature available on Temporomandibular Joint Disorder, a fairly common disorder of the jaw that some trumpet players, including myself, have. I also searched under its common acronym, TMJ with slightly more success. In the end, I manually truncated the words for this disorder to include: temporo mandibular, temporomandibular, disorder, joint, joint disorder, etc. because I was disappointed with the lack of research in this area and hoped to find more. Meticulous attention to spelling ruled out the possibility of omission due to spelling discrepancies.

Next, the RILM (Répertoire International de Littérature Musicale) was searched with much the same technique (see Table 2.3). This time I added new keywords to the search after seeing articles on skin conditions and brass playing. To retrieve articles about brass poisoning/skin allergies, “poison*” was used in column B of the search term spreadsheet. I also included “allerg*” because I have known players with self-diagnosed “allergies” to metal and I was discouraged to find no articles or books written about brass poisoning or metal allergies. Three constructive articles were retrieved in the “allerg*” searches, and the Medline search retrieved more on this fascinating topic.

Continuing in my journal article investigation, I searched IIMP (International Index to Music Periodicals) in the “citations and full article text” mode using the identical
search term spreadsheet as *RILM* (see Table 2.3). In this search, I encountered a noticeably higher incidence of search results with no relevance to my topic because this index searches for the keywords within the citation and the article’s full text. For this reason and resulting sheer number of hits for each search, I used proximity limiters to narrow the number of hits down to articles that would most likely be pertinent to my research. Fortunately, this database did produce documents that were not found in the previous search engines. Due to the nature of the publications compiled in this database, most sources found here tend to be less scholarly and written for general information. This is also apparent by examining the list of the journals indexed in *IIMP* (i.e., no medical journals). Nonetheless, often the information was helpful to those not in the medical field and most articles were surprisingly written by medical doctors in the “Health” section of the journals.

After consulting with a research librarian at The Ohio State University’s John A. Prior Health Sciences Library, I searched *MEDLINE* using the *Pubmed* interface (one of three OSU interfaces used to search *MEDLINE*). Because this database consists entirely of medical research, a different search strategy was needed. It would be redundant, for instance, to search for “trumpet and medic*” as all of the results would already be medical in nature. Moreover, a search for “horn” alone retrieved innumerable results for articles discussing issues with the *horns* of the uterus. Therefore, my search strategy involved the use of the instrumental categories alone: trumpet, horn and brass. Since there would likely be relatively few articles written on anything pertaining to the musical instrument, trumpet, the likelihood of a relevant match was fairly high. Hence, the most successful search method in all three cases was to add the *MeSH* (Medical Subject
Heading), “and music*,” to the keyword search. This ensured the likelihood that entries retrieved would pertain to the musical instruments.

In an effort to exhaust this database, I then searched for “music*” using truncation. This produced 10,570 hits. To narrow my search, I went to an article I retrieved from this search that was directly in my field of study and used its MeSH subject heading coupled with “and music*” in the keyword index. This search (“music* and occupational diseases/etiology”) retrieved 20 significant sources of 186 total results. Next I went back to the Meyer article and searched under “related articles.” This strategy generated eleven noteworthy articles of 168 retrieved.

The next step in this comprehensive literature search was to search all of the “related articles” on the sources that are most directly on the topics of interest in the present survey. For example, each item retrieved using a keyword search in Pubmed generated a list of “related articles.” This feature of Pubmed, in particular, produced another harvest of documents pertaining to this research. This was especially helpful in finding research about related medical problems whose exact wording differed enough that my preliminary search strategies would have overlooked them.

Finally, each available bibliography from the collected sources was perused to find the significant sources that impacted their research. I was pleased to find that these bibliographies often contained sources that were already found in my bibliography. Occasionally a new significant source was found and these sources were then retrieved and annotated for inclusion in this bibliography.

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10 Ibid.
In conclusion, I am pleased to find that there is an abundance of scholarly research in the field of medicine and trumpet playing. Unfortunately, the vast majority of the sources available exist in isolation in the archives of medical journals and in scattered articles in various other journals. The few books that exist are typically broad overviews of the medical considerations of instrumentalists as a group, or are only concerned with a single medical condition. The scattered wealth of sources that my comprehensive literature search uncovered validates my ambition to collect and assemble extant literature on the medical problems of trumpeting, as there seems to be nothing published to serve as a resource for trumpet playing musicians, physicians and teachers. Obviously, due to the unique embouchure and physicality of trumpeting, the medical problems of the trumpet player are far different from those of a pianist, guitarist or even of other wind instrumentalists, and therefore require specialized research. This single document presents this specialized medical research and will be a helpful service to the instrumentalist community and a valuable resource for researchers treating these disorders.
CHAPTER 3

AN ANNOTATED BIBLIOGRAPHY

ANATOMICAL, PHYSIOLOGICAL & HISTORICAL RESEARCH

The findings of this sub-unit of the bibliography are miscellaneous in content. Many sources examine in detail the anatomical and physiological processes at work during trumpet performance. Their inclusion is intended to explain the normal functions of trumpet playing in preparation for the study of the abnormal medical problems which follow. For instance, the research by Barbenel, Kenny, and Davies below confirms that mouthpiece pressure during trumpet performance is contingent upon the pitch and volume played- not the ability or genre of the musician.\textsuperscript{11} Furthermore, the dissertation and subsequent article by Hunsaker state there are no cumulative adverse effects on the cardiovascular system due to trumpet playing, though heart response during trumpeting is markedly higher.\textsuperscript{12} Interestingly, the 1959 study by Faulkner and Sharpey-Schafer states that “dizziness and blackout” may occur secondary to trumpeting due to the continuous mouth and arterial pressures via a “formidable Valsalva maneuver.”\textsuperscript{13} On the contrary,

\textsuperscript{11} J. C. Barbenel, P. Kenny, and J. B. Davies, abstract for \textit{Pubmed} record number 3417693.
\textsuperscript{12} Leigh Anne Hunsaker, abstract for \textit{Proquest Dissertation Abstracts} record number 9413360.
Larger and Ledoux asserted in 1996 that the comparison of horn playing pressure to that of the Valsalva maneuver is faulty as there is not sufficient pressure in correct horn playing to warrant such maneuver” (compressing air in the lungs after inhalation similarly used in childbirth).  

14 The research by Pantev, Ross, et al. is particularly enlightening on the phenomenon of cortical plasticity in musicians, a debatable cause of task specific focal dystonia. This study examines the “normal” plasticity of the cortex in trumpeters and is a good introduction to the research linking cortical plasticity and instrumental musical training found in the Nervous Disorders subsection of this bibliography. Specific discussion of the debate on the etiology of focal dystonia is found on page sixty-three.

Other researchers found here, such as Cayea, Manchester, Clairet, and Betuel, present the epidemiological data on various disorders. Of particular interest in this category are studies comparing the medical problems of trumpet players with those of other instrumentalists. In this area, Daubine-Coulombez, and Vigroux found that though the brass players they studied typically drank more coffee and smoked more, they had lower blood pressure, less superficial orofacial medical problems, such as chapped lips, and less prescribed anti-stress medication.  

15 However, they also found that brass instrumentalists have a higher incidence of focal dystonia, dizziness and heart palpitations.  

Other miscellaneous sources include subjects such as: pathogenic bacteria found in wind instruments, contact dermatitis from playing the trumpet or horn, the effects of

15 Catherine Daubine-Coulombez, and Hélène Vigroux, abstract for *RILM* record number 1999-10492.
16 Ibid.
trumpet playing on blood pressure, wandering atrial pacemaker (i.e., dysrhythmia due to shifts in the site of origin of the impulses controlling the heart rate within the atria), internal pressures secondary to trumpet playing, tongue strength and endurance studies, functional disorders of the upper airway, and whether or not prescription antacids will prevent lacquer damage to brass instruments by reducing the salty acids in skin perspiration. The final subset includes historical data on the medical and dental problems of trumpet playing.


This article examines the uncommon bacteria found in wind instruments. No published English abstract or untranslated Italian title of this article is available for this source using the accessible libraries and indexes. For more information, see Pubmed record number 4463986.


“Discusses the medical problems that have befallen wind and brass players through the years; clinical observations are included.”


In response to Dr. Barysh’s inquiry regarding the prevention of wear on brass instruments from acidity in the saliva and perspiration, Dr. Aronoff recommends first ruling out the need to have the aging instrument re-lacquered. Aronoff recommends prescription antacids if the patient indeed has an acid disorder and the use of lightweight cotton gloves to prevent wear from perspiration on the bell and valves.

17 André-François Arcier, abstract for RILM record number 1999-10472.

“The study's purpose was to describe selected laryngeal activity of brass-wind players during the performance of selected musical exercises. Research problems included the observation and description of three internal areas of activity of ten trumpeters as they performed each exercise. Specific areas of observation were (1) movement of the epiglottis during the performance of each exercise, (2) movement of the vocal folds/arytenoid cartilage which includes changes in the size of the glottis during the performance of each prescribed exercise, and (3) movement of the thyroid cartilage during the performance of each prescribed exercise.

Musical exercises performed by each of the subjects included a sound volume change, use of vibrato, single-tonguing, step-wise descending and ascending slurs, descending and ascending lip slurs, register change, and a descending chromatic scale. In addition, each subject performed an excerpt from the second movement of the Haydn Trumpet Concerto. Data were collected through direct observation of subject performances and then described using three different means.

Data analyses revealed a prominent amount of highly individual, non-patterned laryngeal activity which played an integral role in the performance of each subject. Individuals including Law (1960), Cramer (1955), Jacobs (Stewart, 1987), and Noble (1964) have advocated an unrestricted airway during brass performance. Contrary to this advice, findings in the present study indicate that a great deal of varying, involuntary restriction is present in the laryngeal area during performance. Further, such activity appears necessary to brass performance.

Others, including Farkas (1962), Schuller (1962), and Wick (1971), have endorsed conscious use of the glottis during brass performance. While findings in the present study imply that there is a presence of voluntary or reflexive glottal activity during brass performance, evidence does not support any theory which suggests conscious use of the laryngeal mechanism.”


“A transducer for measuring the force applied to the trumpet mouthpiece during performance is described. The device allowed the players to perform on their own instrument and in their usual manner. The results of tests on 60 subjects showed that during playing the force between the mouthpiece and instrument increased with increasing loudness and ascending pitch but that there was no significant correlation between mouthpiece force and proficiency or style. The maximum force which the players could tolerate was greater for high proficiency players than for medium.”


“The artificial mouth is a robotic device that simulates a human mouth. It consists of moveable lips and an adjustable air supply. The uses of an artificial mouth include research for

18 Robert Elwood Bailey, abstract for Proquest Dissertation Abstracts Online record number 9016161.
19 J. C. Barbenel, P. Kenny, and J. B. Davies, abstract for Pubmed record number 3417693.
physical modeling of the lips and automatic performance. Automatic performance of a musical instrument is when an instrument is played without the direct interaction of a human. Typically mechanics and robotics are used instead of a human. In this study the use of a genetic algorithm to compute air pressure and lip pressure values so that the artificial mouth can correctly play five notes on a brass instrument is investigated. In order to properly play a brass instrument, a player must apply proper tension between the lips and apply proper airflow so that the lips vibrate at the proper frequency. A player changes the notes on a brass instrument by depressing keys and changing lip pressure and air flow. This study investigated a machine learning approach to finding lip pressure and air pressure parameters so that an artificial mouth could play five notes of a scale on a trumpet. A fast search algorithm was needed because it takes about 4 seconds to measure the frequency produced by each combination of pressure parameters. This measurement is slow because of the slow moving mechanics of the system and a delay produced while the notes are measured for pitch. Two different mouthpieces were used to investigate the ability to adapt to different mouthpieces. The algorithm started with a randomly generated population and evolved the lip pressure and air pressure parameters with an evolutionary algorithm using crossover and mutation designed for the knowledge scheme in this application. The efficiency of this algorithm was compared to an exhaustive search. Experimentation was performed using various combinations of genetic parameters including population size, crossover rate, and mutation rate. The evolutionary search was shown to be about 10 times faster than the exhaustive search because the evolutionary algorithm searches only very small portion of the search space. A recommendation for future research is to conduct further experimentation to determine more optimal crossover and mutation rates.


“In order to assess the actual load on front teeth and tooth supportive tissue during brass instrument playing, a measuring system was developed permitting simultaneous recordings of mouthpiece forces and incisor deflections. By the application of strain gauges, the mouthpiece itself was converted into an extra-oral force transducer, whilst an intra-oral metal appliance similar to a removable partial denture served as the base for strain gauge transducers sensing incisor displacements. The measurements only slightly affected the handling of the instruments under examination (trumpet, French horn, tenor horn, and tuba) and yielded the following average results for three to five players per instrument: peak force values were in the range of 29 N (tuba) to 50 N (trumpet), and the respective peak displacements were 43 microns and 100 microns.


The cardiovascular changes observed secondary to horn playing are studied to explore the hypothesis that the intense respiratory strain used in horn playing may cause occasional loss of consciousness. This strain is sustained intra-oral pressure which exceeds that used for clinical observation in the Valsalva maneuver. This supports Tucker’s demonstration that young brass


21 Lothar Borchers, Matthias Gebert, and Till Jung, abstract for Pubmed record number 8564150.
players are exceedingly disposed to cardiac arrhythmias. This study dispenses a uniform musical exercise to a cross-section of French horn players to determine if adaptive changes have arisen that contribute resistance to the stress of performance on brass instruments.


“Occupational injuries of musicians may be preventable by implementing intervention strategies. A prevention program was developed, combining the use of musculoskeletal education and specific exercise protocols, focusing on the upper extremity. Six orchestras served as experimental subjects and three orchestras as controls. Lectures were given to all volunteers, and all filled out questionnaires. Each participant was assigned to one of two types of exercises: one emphasized strengthening and the other flexibility. The study had a very high attrition rate, negating the significance of much of the data collected. However, some information may be useful in designing future studies. The improvement in musculoskeletal symptoms among both the experimental and the control subjects suggests that simply allowing these musicians to focus on their problems represented a positive intervention. Three-fourths of the respondents indicated that they would consider participating in a similar study, and an even larger proportion indicated that they would continue some of the exercises on their own. The health insurance carrier of one of the experimental orchestras reduced its rates as a consequence of fewer claims.”


The general state of research in the field of musicians’ injuries is described. Musicians and physicians are admonished to hold research in this budding field to a high scientific standard, rather than applauding unrealistic progress in research. This necessitates the “art” of medicine, as typical musicians’ medical problems are often vexing. Various impediments to the scientific process are examined. Dr. Brandfonbrener concludes by advising the importance of forewarning and proper education to musicians before problems arise.


“This study was undertaken to discover the identity of bacteria that exist in brass wind instruments. The study sample, (N = 25), was a stratified, random quota sample consisting of five trumpets, five horns, five trombones, five euphoniums, and five tubas from a university band program. Of these twenty-five instruments, nine were used in the concert band and sixteen were used in the marching band. From these instruments, the twenty-five from the main study and one from the pilot study, 431 bacterial isolates were extracted. Of these 431 bacterial isolates thirty-seven were chosen for study through biochemical procedures and 16s PCR. PCR was performed, the DNA for each organism was sequenced, the DNA sequences were submitted to an internet search engine and the organisms were identified. The organisms identified through these procedures included: (a) Bacillus anthracis; (b) Bacillus cereus; (c) Flavobacterium mizutaii; (d) Mebsiella pneumoniae/oxytoca; (e) Microbacterium arborescens; (f) Micrococcus luteus; (g) Pseudomonas aeruginosa; (h) Pseudomonas beteli; (i) Pseudomonas stutzeri; (j) Sphingobacterium spiritivorum; (k) Staphylococcus aureus; (l) Staphylococcus epidermidis;”

22 Alice G. Brandfonbrener, abstract for RILM record number 1997-07368.
Brass instruments contain bacteria. Some of the bacteria found in these instruments are pathogenic and can cause serious disease should the immune system of the player be compromised. Further research is needed to identify the complete bacterial flora of instruments, to identify possible viral and fungal flora that exist in brass instruments and to develop procedures and materials to quickly disinfect instruments.”


“Physiologically, when the mouthpiece is placed against the lips and a hermetic seal is formed, pressure from the rim causes ischemia, with resultant passive hyperemia due in part to the Di Palma effect. Initial blowing of the instrument appears to induce vasodilation which accounts for the passive hyperemia, and as blowing continues hypoxia causes various metabolic changes that result in labial deformation and a loss of sensitivity.”

“Finally, and perhaps the most interesting finding in the present investigation was that of the apparent divisions within the trumpet performer group. Three of the nine subjects recorded an arterial oxyhemoglobin saturation level of below normal. No doubt the players rate as the finest trumpet performers in the undergraduate music program at the University of Oklahoma. Objectively, on the range and endurance scale in this study, these players ranked at the top. As evidenced by this study, with only a small sample, strength may not be a prime asset for offering a resistance to the external forces of the mouthpiece. It is entirely possible that some metabolic factor may be of greater significance than ever before conceived.”


“Instrument-specific injury rates of students at a university-level music school were studied over a 14-year period. The overall injury rate was 8.3%. The instruments were divided into low-, medium-, and high-rate tertiles based on their associated injury rates. Brass instruments, as well as the oboe and bassoon, were in the first tertile. Medium-injury-rate instruments included the bowed string instruments, saxophone, clarinet, organ, flute, and percussion. The piano, guitar, and harp fell into the highest tertile. Women had a higher overall injury rate than men.”


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25 Ibid., 77.
26 Danelle Cayea and Ralph A. Manchester, abstract for RILM Vol. 32, no. 16158.
“Presents the results of a 124-item self-assessment questionnaire completed by 220 French music students in three age groups: under 15 years (24%), 15–20 years (40%), and over 20 years (36%). The subjects were students of piano (84), guitar (33), violin (21), saxophone (16), flute (15), harp (7), horn (6), violoncello (5), trumpet (5), singing (4), bassoon (4), string bass (3), trombone (3), clarinet (3), tuba (3), oboe (2), harpsichord (2), accordion (1), and synthesizer (1). Ninety-seven students mentioned a problem requiring medical attention, related to the spine (43%), stage fright (13%), hearing (9%), tendons (8%), eyes (8%), and head (7%). The goal of the study was not only to determine the specific medical needs of a population of young musicians, but also to better define the factors that contribute to the various problems.”


“Thirty-eight musicians, evenly divided between woodwind and brass performers, underwent cardiological, opthalmological, stomatological, and ear-nose-and-throat examinations. Notable differences were revealed between the two groups. Despite the fact that brass players drank more coffee and smoked more, the woodwind players tended to have higher blood pressure. The use of anti-stress medication was considerably higher among woodwind players, as was the incidence of superficial lip problems such as cracking, drying, and formation of callouses. Brass players, however, suffered more from dizziness, heart palpitations, and functional dystonias (cramps).”


“Hypertension in a French horn player is briefly discussed. Blood pressure measurements were made while the patient played a scale and while at rest. An immediate and progressive increase in diastolic pressure was associated with horn playing, and there was a correlation between diastolic pressure and the frequency of the note. Clinical relevance of blood pressure increases during horn playing is unknown, but brass players’ folklore indicates a raised incidence of conjunctival (eye) hemorrhages, retinal detachments, and cerebrovascular accidents (stroke).”


“Two cases of ischemic stroke due to carotid artery dissection occurring during wind instrument playing, probably caused by increased intrathoracic and subsequent intrapharyngeal
pressure, are presented. A review of the literature revealed three similar patients with other types of cerebrovascular events, such as paradoxical cerebral embolism due to a patent foramen ovale and spinal epidural hematoma during trumpet playing."


“Continuous mouth and arterial pressures were recorded during trumpet playing. A professional reached 160 mm. Hg blown pressure on loud high notes; less skilled performers were unable to reach such pressures. The circulatory effects of prolonged playing were those of a formidable Valsalva manoeuvre. Dizziness or black-out may result.”


“Measurements of sound output as a function of blowing pressure are reported for a group of experienced trumpet players. The study identifies several common features, namely (1) a threshold blowing pressure approximately proportional to the frequency of the note being played, (2) an extended region in which the sound output rises by about 15 dB for each doubling of blowing pressure, and (3) a saturation region in which sound output rises by only about 3 dB for a doubling of blowing pressure. Some players are able to blow with maximum pressures as high as 25 kPa, which is significantly greater than normal systolic blood pressure. A simple theory is presented that provides a physical explanation for the acoustical behavior, but a detailed treatment requires solution of the nonlinear coupled equations both for the lip-valve mechanism and for nonlinear wave propagation in the instrument tube. Frequency analysis of the sound shows a basic spectral envelope determined by the resonance properties of the mouthpiece cup and the radiation behavior of the bell, supplemented by an extension to increasingly high frequencies as the blowing pressure is increased. This high-frequency behavior can be attributed to nonlinear wave front steepening during sound propagation along the cylindrical bore of the instrument.”


“An interview with the horn player Lars Kristiansen, whose nickel allergy forced him to give up playing, and the horn maker Engelbert Schmid, who has produced a nickel-free horn for him.”


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30 S. Evers, et al., abstract for Pubmed record number 10994010.  
32 N. H. Fletcher and A. Tarnopolsky, abstract for Pubmed record number 9972572.  
33 Martin Gottschalk, abstract for RILM record number 2005-00317.
“Although this study does not address the long-term effects of horn playing or the effect of performance stress on blood pressures, it offers reassurance that for most individuals blood pressures do not rise while simply playing. Although a few experience a transient rise in the extreme high register, others actually progressively drop their pressure as they play higher. Dimsdale and Neselen state that a prolonged Valsalva manoeuvre is used to produce high notes, but closing the glottis while playing is not recommended and results in poor tone quality.”


“In the last two decades, injuries to instrumental musicians have been well documented. Major categories of performance-related injuries include musculoskeletal overuse, nerve entrapment/thoracic outlet syndrome, and focal dystonia. Other areas of concern to instrumentalists include hypermobility, osteoarthritis, fibromyalgia, and hearing loss. This chapter reviews the epidemiology, risk factors, physical exam, treatment, and prevention of common problems of instrumentalists. Emphasis is placed on the team approach of treatment and prevention and the need for close collaboration of the various health professionals, music educators, and performers. Additional resources are presented for those interested in pursuing performing arts medicine in greater detail.”


“The purpose of this study was to investigate the effects of trumpet playing upon the heart. A Holter monitor was used to record electrocardiograms (ECGs) to examine the heart’s response during musical performances and practice sessions.

The study design included two phases: a comparison of the heart rate at rest and while playing a standard etude and a comparison of heart response while playing selected music in both practice and performance situations. An analysis of the ECGs was performed by a cardiologist and an ECG technician, who examined both the heart rate and the regularity of the heart rhythm.

Results of the first phase of the study showed that the heart rate during trumpet playing was significantly higher (p<.0001) than when resting. In the second phase of the study, all but one subject had a faster heart rate during a performance than when practicing the same music.

The medical professionals evaluated the ECGs, medical history, and daily activity logs of subjects to characterize ECG changes as induced by the instrument playing, or as caused by other means. Disturbances in the heart rhythm were more common and more pronounced in performances than in practice. Dramatic, but temporary changes in the heart’s rate and rhythm were recorded during trumpet playing. No adverse effects to the cardiovascular system were attributed to trumpet playing.

In addition to the above findings, the ECGs were examined for evidence of a cumulative increase in stress upon the heart during practice sessions. The subjects were instructed to use their customary warm up and to continue practicing in their normal manner. Because information on the routine demands of trumpet playing was desired, the practice procedures and materials were not dictated. A comparison of the first and last five minutes of each practice session showed little

35 R. A. Hoppmann, abstract for *Pubmed* number 11567922.
change in heart rate or rhythm. No cumulative effect of trumpet playing was found in the heart response of these subjects.\textsuperscript{36}


“The effects of trumpet playing upon the heart were investigated by obtaining electrocardiograms during practice sessions and musical performances. The study design included two phases: a comparison of the heart rates at rest and while playing a standardized etude, and a comparison of the heart rates and rhythm responses while playing selected music in both practice and performance situations. Results of the first phase of the study showed that the heart rate during trumpet playing was significantly higher (p< 0.0001) than it was when resting. In the second phase, all but one subject had a faster heart rate during a performance than when practicing the same music. Disturbances in heart rhythm were more common and more pronounced in performance than in practice.”\textsuperscript{37}

“Although pronounced changes in the heart’s rate and rhythm were recorded during trumpet playing, none of these effects persisted after playing. Similar, temporary ECG changes have been reported for healthy athletes during physical activity. The data provided no evidence of any adverse effect of trumpet playing on the cardiovascular system of otherwise normal subjects. In the absence of other symptoms, these ECG changes can be considered normal variants that occur as a function of instrument playing.”\textsuperscript{38}


“Mouthpiece pressure and movement of the teeth during brass playing were measured via strain gauges placed inside and outside the mouths of ten players of the trumpet, horn, tenor bugle, and tuba. Mouthpiece pressure varies by instrument, depends upon the pitch of the note being played, and is not uniformly spread across the four incisors. Tooth movement may reach the physiological limits of dental mobility. It is recommended that removable supports be worn during performance to help stabilize teeth.”\textsuperscript{39}


“A strain gauge device was developed to measure the forces exerted in two dimensions on the trumpet mouthpiece during performance.

\textsuperscript{36} Leigh Anne Hunsaker, abstract for \textit{Proquest Dissertation Abstracts} record number 9413360.
\textsuperscript{37} Leigh Anne Hunsaker, “Heart Rate and Rhythm Responses during Trumpet Playing,” \textit{Medical Problems of Performing Artists} 9, no. 3 (September 1994): 69.
\textsuperscript{38} Ibid., 72.
\textsuperscript{39} Till Jung, Lothar Borchers, and Matthias Gebert, abstract for \textit{RILM} record number 2000-06346.
A group of top professional performers (n = 30) and a group of intermediate players (n = 30) were tested on a wide variety of musical material with mouthpiece force as the dependent variable. Data from the long note exercise in the normal register revealed significant effects for pitch and intensity on the dependent variable. No proficiency effects were observed. The scale and arpeggio exercises revealed a remarkable consistency in the application of mouthpiece force by all the subjects, such that force levels at each selected pitch/intensity combination appeared to be independent of context. The lip flexibility exercise however revealed significant contextual influences, and it was suggested that musical complexity might be responsible for this. Some proficiency related effects were observed: the professional players had greater levels of maximum tolerable forces, displayed more endurance and were more consistent in the application of mouthpiece force than the intermediate players across the range of tests.

An investigation was carried out on the assessments by trumpet players of the mouthpiece force usage of other players. The judgments involved rating photographs of players performing notes at known force levels. Groups of subjects differing in proficiency showed a high consensual agreement in judgments of mouthpiece force. However, equivalent proficiency groups rating the same photographs according to the criterion of apparent effort yielded almost identical rankings, suggesting that mouthpiece force judgments are made on the basis of this erroneous cue. The extent of consensual agreement and judgmental accuracy was found to be independent of proficiency level.

A psychophysical investigation of mouthpiece force using ratio production, magnitude production and magnitude estimation methods produced logarithmic sensory functions for both individual and group data. Judgmental accuracy was found to be unrelated to proficiency level.


As the title implies, this dissertation examines the measurements of the physiological factors of trumpet playing. No English abstract available. For more information, see: http://www.crl.edu/content/DissLinkPQDD.asp.


After measuring the heart rates and blood pressure of an experienced hornist while sustaining pitches throughout the horns range for twenty-five seconds, the French horn does not appear to increase diastolic blood pressure. The heart rate does seem to increase with increased range. The comparison of horn playing pressure to that of the Valsalva maneuver is faulty as there is not sufficient pressure in correct horn playing to warrant such maneuver.


“Several known functional disorders of the upper airway are associated with playing wind instruments. Some of these problems have been known for hundreds of years.

40 Patrick Kenny, abstract for Proquest Dissertation and Abstracts record number 744225351.
Subcutaneous emphysema of the head and neck and parotid, palate paralysis, patulous Eustachian tubes, laryngocoele, and pharyngocoele are some of the more common problems. In evaluating disorders of wind instrumentalists, it is important to obtain a history that is unique to the individual, including information about the work environment, playing technique, and length of time playing. Physicians should understand the differences in wind instruments, mouthpieces, and reeds to understand the pathologic problems that occur in wind instrumentalists. This paper serves as an introduction to some of the signs and symptoms of these problems and how they are unique in wind instruments."


“The authors examined the relationship between perceived occupational stress and the prevalence of a number of psychologic and physical ailments in a sample of professional symphony orchestra musicians and related musicians' self-reports of stress to demographic and occupational characteristics. Results of a survey of 2,212 musicians from 47 symphony orchestras revealed a significant relationship between perceived occupational stress and prevalence of a number of psychologic as well as physical medical problems. Age and occupational factors, such as the orchestra in which the musician plays, the instrument played, and status as a soloist, were also found to be significant correlates of perceived stress.”


Despite the importance of music therapy on hospital patients' management, the sharing of instruments with mouthpieces should be avoided without proper cleaning. Potential exists for cross contamination from the build up of biofilm in the mouthpiece from secretions of the salivary glands and oropharyngeal/upper airway. In particular, there is a potential hazard for the transmission of the Gram-negative respiratory pathogens, Pseuedomonas aeruginosa and Burkholderia cepacia complex.


“Nickel is the most frequent metal contact allergen. Nickel sensitivity was observed in 4.5% in the general population, in 8% of females and 0.8% of males. At the time of testing, 34% of the nickel-sensitive subjects showed eczema. In our hospital, out of 24 patients patch tested with the same metal series for 5 months, 8 (33.3%) had positive reactions to nickel sulfate. Some other dermatitis of musicians is due to nickel allergy, a case of guitar-string dermatitis, for

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42 S. E. Middlestadt, and M. Fishbein, abstract for Pubmed record number 3183784.
example. Nickel sensitivity may also be a cause of 'flautist’s chin'. To our knowledge, there are no previous reports of nickel allergy in a trumpet player.”


“Continuous electrocardiographic recordings were obtained in a group of French horn players during performance of identical pieces of music. Half of the musicians developed wandering atrial pacemaker. One example is illustrated. The causative mechanism is briefly discussed. This may represent an "occupational" hazard.”


No English abstract is available for this article. The original untranslated English title is not published in the indexes used in this research. For more information, see *Pubmed* record number 8846956.


“Auditory stimuli are encoded by frequency-tuned neurons in the auditory cortex. There are a number of tonotopic maps, indicating that there are multiple representations, as in a mosaic. However, the cortical organization is not fixed due to the brain’s capacity to adapt to current requirements of the environment. Several experiments on cerebral cortical organization in musicians demonstrate an astonishing plasticity. We used the MEG technique in a number of studies to investigate the changes that occur in the human auditory cortex when a skill is acquired, such as when learning to play a musical instrument. We found enlarged cortical representation of tones of the musical scale as compared to pure tones in skilled musicians. Enlargement was correlated with the age at which musicians began to practice. We also investigated cortical representations for notes of different timbre (violin and trumpet) and found that they are enhanced in violinists and trumpeters, preferentially for the timbre of the instrument on which the musician was trained. In recent studies we extended these findings in three ways. First, we show that we can use MEG to measure the effects of relatively short-term laboratory training involving learning to perceive virtual instead of spectral pitch and that the switch to perceiving virtual pitch is manifested in the gamma band frequency. Second, we show that there is cross-modal plasticity in that when the lips of trumpet players are stimulated (trumpet players assess their auditory performance by monitoring the position and pressure of their lips touching the mouthpiece of their instrument) at the same time as a trumpet tone, activation in the somatosensory cortex is increased more than it is during the sum of the separate lip and trumpet tone stimulation. Third, we show that musicians' automatic encoding and discrimination of pitch contour and interval information in melodies are specifically enhanced compared to those in nonmusicians in that musicians show larger functional mismatch negativity (MMNm) responses


44 P. M. Nizet, et al., abstract for *Pubmed* record number 1245812.
to occasional changes in melodic contour or interval, but that the two groups show similar MMNm responses to changes in the frequency of a pure tone."


This book discusses physiotherapy for injured musicians, anatomy for musicians, preventative measures for injuries to the arm, wrist, and hand, playing ergonomics, exercise protocols for the musical athlete, and improving the working environment.


“Tongue strength and endurance (fatigue) were examined in subjects who have acquired high skill levels with their tongues (supranormal) and in subjects who use the tongue normally. The supranormal groups were trumpet players and high school debaters who were able to speak intelligibly at rates much faster than normal. Hand strength and fatigue were also assessed. Maximal strength was measured by recording how much pressure an individual could exert on an air-filled bulb. Endurance was measured by determining how long subjects could sustain 50% of their maximal pressure. Results showed that maximal strength of the tongue and hand did not differentiate the supranormal subjects from the normal subjects. Hand endurance did not differentiate the subjects either. However, the supranormal groups had significantly longer tongue endurance times than did the normal subjects.”


The importance of dental hygiene for preservation of careers in trumpet performance is illustrated through the examples of various well known trumpet players impacted, some irreparably, by the effects of periodontal disease and other problems of the teeth. Notable trumpeters included are: Joe “King” Oliver, John Faddis, Harry James, Bunk Johnson, Bix Beiderbecke, Buck Clayton, Chet Baker, Miles Davis, Blue Mitchell, and Louis Armstrong.


“Several inspiratory conditions were placed on twenty-nine experienced brass-instrument players. Three test categories were designed to examine the relationships between the vital capacity of brass players and conditions placed on the inspiratory phase of active respiration. Vital capacity is defined as the maximum volume of air expired from the lungs after maximal inspiration. The categories tested: (1) the subjects’ vital capacity after inspiring through breathing tubes of various diameters, (2) the subjects’ vital capacity after four timed inspirations, and (3) the

45 Pantev, C., B. Ross, et al., abstract for Pubmed record number 14681168.
46 D. A. Robin, et al., abstract for Pubmed record number 1494269.
subjects' vital capacity during separate chest and shoulder restriction and during active shoulder lifting.

Subjects were measured during a four-week period. A 13.5 liter water-filled spirometer was used to measure the vital capacity. Tracings were made on chart paper attached to the spirometer. Except for shoulder restriction and lifting, the subjects were seated during the vital capacity maneuvers. The breathing tubes were four-inch-long plastic tubes of three different diameters. A metronome was used as the timing device for the timed inspirations. The mechanical loading of the chest and shoulder regions was accomplished by: (1) strapping the chest region to restrict rib-cage movement, and (2) applying a shoulder harness to restrict the upward movement of the shoulders.

Results were compared to predicted vital capacity as determined by Dockery et al. (1985), and to a set of control measurements taken of the subjects without any respiratory conditions. The use of the breathing tube provided a significant change in the vital capacity of the subjects, but the size of the tube appeared to have little influence. Of the four timed inspirations, only the duration of one-half second provided any significant decrease in vital capacity. Chest strapping produced the greatest reduction of all the tests, closely followed by shoulder restriction. Shoulder lifting showed no significant change from the predicted or control values. The average of the control capacities of all the subjects was not significantly different from predicted values; subjects with lower predicted values generally failed to achieve the predicted values and those with higher predicted values usually met or exceeded their predicted values."

Thomas, Peter, Franziska Rueff, and Bernhard Przybilla. “Cheilitis Due to Nickel Contact Allergy in a Trumpet Player.” *Contact Dermatitis* 42, no. 6 (June 2000): 351-2.

“A 32-year-old man presented with a several-month history of itching, dryness and sometimes scaling of the lips. Various emollients gave no relief. There was no occupational exposure to airborne irritants; no special recreational activities were reported except trumpet playing at weekends. There was no history of atopic diseases or prior allergic contact dermatitis. Examination revealed scaling and partly crusting cheilitis, particularly prominent on the median 1/3 of the lips.

There were no reactions on prick testing with house-dust mite (*D. pteronyssinus*), cat dander or grass pollen. The patient was then patch tested with a standard series, and reactions to the fragrance mix (D2 +, D3 ++) and to nickel sulfate (D2 +, D3 +) were found.

Subsequent use of fragrance-free emollients did not ameliorate the condition. Re-assessment of the patch test results led to the suspicion that contact with his trumpet could be responsible for the cheilitis. Indeed, there was complete healing of the lip eczema following the use of a gold mouthpiece on his trumpet. For more than 1 year, there has been no recurrence of the condition.”


“In the ‘Your Health’ section. Two California researchers have found that playing musical instruments can lead to high blood pressure. The researchers at the University of California at San Diego found that the higher the musical note played by a French horn player,

47 Thomas William Staples, abstract for *Proquest Dissertations and Theses* record number AAT 8903982.
48 Peter Thomas, Franziska Rueff, and Bernhard Przybilla, “Cheilitis Due to Nickel Contact Allergy in a Trumpet Player” *Contact Dermatitis* 42, no. 6 (June 2000): 351-2.
the higher his blood pressure, almost paralleling the rounded curve of a musical scale. Probably picked up from the Dimsdale article above and reprinted."


Descriptions of the internal pressures of trumpet playing are given, as well as their general effects upon the trumpeter. Other perils and physiological facets of trumpeting are briefly discussed, including respiratory distress, hearing loss, and trumpeter’s cramp and cerebellar function.


“An electromyographic study with fine-wire electrodes of the orbicularis oris muscles in the upper and lower lips, the elevator anguli oris and depressor anguli oris in eighteen trumpeters reveals a relationship between levels of skill and certain aspects of muscular activity in individual muscles during performance. Intensity and register vary directly with the level of activity at all levels of skill. Beginners have greater muscle activity in the upper lip than in the lower while advanced players (concert artists) do not, indicating that this activity should be suppressed for better performance. Beginners also showed greater variability of muscle activity in general. Muscle activity ceases abruptly in all types of players at the end of the tone.”


This source lists organizations that specialize in the medical treatment of musicians. For more information, see Pubmed record number 12852677.


“Musicians are a unique group, requiring digital control and skills at the highest levels. Each instrument has its own special needs and the musician must be seen in the context of the instrument played. Surgery also must be seen in this context. The special areas of modification of technique and some of the more common surgical situations encountered in musicians are considered in this article.”


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49 Marc David Horowitz, “Horn Citations in Recent Medical and Scientific Literature,” *The Horn Call* 28, no. 3 (May 1998): 60.
51 I. Winspur, abstract for Pubmed record number 12852667.
A review of medical literature finds that brass is a potential toxin, though it is an insignificant risk to brass playing musicians. Brass, particularly brass dust, is toxic to animals; however, contact with brass via playing a brass instrument should not result in any form of reaction. In rare cases, a hypertensive musician may develop a localized rash from contact with brass. Treatment options include avoidance through plating the exposed brass and steroidal cream. The rash manifests itself in a manner consistent with Herpes labialis. Observation will reveal the true cause of such rash.


Dr. Yu differs with Dr. Aronoff’s consultation in *JAMA* 226 (1973), page 213, stating that the pH levels of saliva and perspiration are not effected by antacids and will not prevent wear on the instrument. The pH of saliva is normally only slightly acidic, only pH 6 to 7. Furthermore, the condensation in the horn is mostly from humidity in the breath and contains only negligible amounts of saliva. Normal dosages of antacids would not affect the pH of the saliva or perspiration as the acidity in the liquid comes from the dissolved carbon dioxide, carbonic acid. A clear plastic covering around the instrument is recommended for preventing lacquer wear from perspiration.
HEARING LOSS

The trumpet is a highly directional instrument often played in high decibel venues. This places both the trumpet player and those in front of the trumpet player at risk for hearing loss. The following research discusses the long-term effects of trumpet playing on hearing loss and its prevention, presents comparative statistical data, compares sound levels recorded in typical trumpet performance venues (e.g., concert band and orchestra), and discusses tinnitus (ringing in one’s ears).

Within this field of research, certain studies are closely related and can be linked, providing different facets of information on each topic. The first group is epidemiological in subject matter. Axelsson and Lindgren’s study shows that males are more susceptible to noise-induced hearing loss than women, particularly brass playing men.\(^{52}\) These findings are supported by the research of Ostri, et al.\(^{53}\) Chesky and Henoch’s epidemiological investigation makes the significant revelation that 25.4% of classical trumpet players report hearing loss, as do 37.8% of non-classically trained players.\(^{54}\) A second group of interrelated studies explores the use of hearing protection. The article by Laitinen, et al.,\(^{55}\) combined with the research of Zander, Spahn and Richter\(^{56}\) provides a thorough discussion of this subject. The remaining group of studies

presents valuable information on the prevention of noise induced hearing loss. The researchers of this third and largest group of studies include the following: Chasin, Hill, McBride, et al., Teie, and Zembower, Christian M. Fortunately, all agree that noise induced hearing loss is highly preventable.


“Hearing tests in classical musicians have been few and results have been inconsistent. Sound level measurements from the Lyric Theater and Concert Hall in Gothenburg showed sound levels frequently exceeding hearing damaging levels. Hearing tests of male and female musicians from both theaters indicated a sensorineural high tone loss, consistent with an etiology of a noise-induced hearing loss. Males were worse than females; brasswind instruments exhibited the greatest loss. For individual instruments, French horn, trumpet, trombone, and bassoon showed an increase in risk of sensorineural hearing loss. In conclusion, sound level measurements and hearing tests indicate the ototraumatic character of classical music by orchestras on a stage or pit. The finding is serious with regard to the unusual dependence of musicians on their hearing sensitivity. Very long, detailed, and technical thesis. Twenty-two references.”


“Suppression of transient-evoked otoacoustic emissions was recorded from 29 members of the Louisiana Philharmonic Orchestra and 28 non-musician control subjects matched for age and gender. Binaural broad band noise was used as the suppressor stimulus in a forward masking paradigm. Results showed musicians to have significantly more suppression than non-musicians for both the right and left ears. Two possible explanations for this functional difference between groups are that moderately loud music serves as a sound conditioning stimulus and that music can be a mechanism for strengthening central auditory pathways which may influence the olivocochlear reflex arc. Possible explanations for this are discussed and ear, gender, and age differences within each group are examined. Additionally, middle-ear muscle reflex thresholds were found to be higher in musicians than non-musicians at some frequencies in some conditions.”


Marc David Horowitz, “Horn Citations in Recent Medical and Scientific Literature,” The Horn Call 28, no. 3 (May 1998): 60.

S. M. Brashears, et al., abstract for Pubmed record number 14552425.
In this self-published book, Chasin presents suggestions for protecting the hearing of music students and educators.


The four environmental techniques for reducing the effect of music exposure on musicians’ hearing are: elevating speakers and amplifiers from the floor, placing the treble brass instruments on risers, maintaining unobstructed floor space in front of the orchestra, and allowing small stringed instruments to always have at least two meters of unobstructed space above them.


Classically trained musicians have a lower record of hearing loss in every instrument. Over all, 25.4% of classical trumpeters report hearing loss, and 37.8% of non-classically trained players. This shows that the average classically trained trumpet player has a 12.4% better chance of not developing hearing loss than the non-classically trained player.

The highest percentage of hearing loss comes from non-classically trained trombonists, followed closely by non-classically trained trumpet players by a margin of only 6.2%. Over all, 19.8% of classical musicians report problems with hearing loss. On the other end of the musical spectrum, 32.8% of musicians in popular non-classically trained genres, such as Rock, report a problem with hearing loss.


“The authors report their observations on the auditory status of 76 musicians belonging to a Republican Guard brass band, and give their interpretation of abnormal findings, as they compare percussion with wind instruments and make reference to literature data. Accompanying signs, such as ear fatigue, noise intolerance, tinnitus, ear-aches, disturbance of sleep, psychic disorders, and disturbances of equilibrium are also taken into account as predisposing factors. Lastly, an attempt is made to bring out some of the characteristics that are specific to each instrument.”


“The sound in classical orchestral music is louder than noise emissions allowed by national rules in industry. We wanted to assess the audiologic status of professional musicians at

59 Cudennec, Y. F., et al., abstract for *Pubmed* record number 2256613.
different ages of their careers and to look for a coherence of declined hearing ability and the sound emissions in order to substantiate advices for hearing protection and occupational medicine in musicians. Data from questionnaires (anamnestic data on sound exposure in profession and leisure times, use of hearing protection, self-evaluation of hearing function and hearing deficits), audiometric data and amplitudes of OAE were evaluated from 109 professional musicians aged 30-69 years from three major German orchestras and from 110 students of an academy of music (aged 11-19 years). Sound emissions of the whole orchestra and of single instruments/instrument groups were measured at the orchestra stages and pits during rehearsals and performances. None of the musicians was engaged in noisy hobbies and only a few used hearing protectors regularly. More than 50% of the musicians had a hearing loss of 15 dB (A) and more. Highest losses were found among the strings and the brass players. DPOAE amplitudes coincidently declined with the duration of performing music in the orchestras. Professional musicians aged older than 60 years had a significantly greater hearing loss at 4 and 6 kHz than those aged 30-39 years. Among the strings in one orchestra a dominant hearing deficit in the left ears was observed. Musicians need the same health care for their hearing as workers in noisy industry. A better education on the hearing hazards (use of hearing protectors) as well as sound protection in the rehearsal rooms is necessary. Hearing loss in professional musicians should be accepted as an occupational disease.


The causes and preventions of hearing loss on music educators, conductors and musicians are listed. Symptoms of the onset of hearing loss are given for an informal self-diagnosis. A discussion of hearing aids and other life adaptations for those with hearing loss are given, followed by preventative measures.


“Exposure to loud sounds is one of the leading causes of hearing loss in the United States. The purpose of the current research was to measure the sound pressure levels generated within a university concert band and determine if those levels exceeded permissible sound limits for exposure according to criteria set by the Occupational Safety and Health Administration (OSHA) and the National Institute of Occupational Safety and Health (NIOSH). Time-weighted averages (TWA) were obtained via a dosimeter during six rehearsals for nine members of the ensemble (plus the conductor), who were seated in frontal proximity to “instruments of power” (trumpets, trombones, and percussion; (Backus, 1977). Subjects received audiometer tests prior to and after each rehearsal to determine any temporary threshold shifts (TTS). Single sample t tests were calculated to compare TWA means and the maximum sound intensity exposures set by OSHA and NIOSH. Correlations were calculated between TWAs and TTSs, as well as TTSs and the number of semesters subjects reported being seated in proximity to instruments of power.

The TWA-OSHA mean of 90.2 dBA was not significantly greater than the specified OSHA maximum standard of 90.0 dBA ( p > .05). The TWA-NIOSH mean of 93.1 dBA was,

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60 E. Emmerich, L. Rudel, and F. Richter, abstract for Pubmed record number: 18034257.
however, significantly greater than the NIOSH specified maximum standard of 85.0 dBA ($p < .05$). The correlation between TWAs and TTSs was considered weak ($r = .21$ for OSHA, $r = .20$ for NIOSH); the correlation between TTSs and semesters of proximity to instruments of power was also considered weak ($r = .13$).

TWAs cumulatively exceeded both associations’ sound exposure limits at 11 specified locations (nine subjects and both ears of the conductor) throughout the concert band’s rehearsals. In addition, hearing acuity, as determined by TTSs, was substantially affected negatively by the intensities produced in the concert band. The researcher concluded that conductors, as well as their performers, must be aware of possible damaging sound intensities in rehearsals or performances.61


“Investigations into noise-induced hearing loss should consist of two parts: a mapping of the sound environment and a charting of hearing loss. This paper is the first part of such an investigation: a mapping of sound levels and sound spectra within the symphony orchestra. It was found that 'heavy' symphonic music exceeds the permitted dose for industrial noise equivalent to 85 dB (A) for a full working week. The permitted noise dose is reached for 'heavy' music after a working time of 10 hours per week in 'exposed' positions, such as in front of trumpets, and after 25 hours in 'normal' positions. A simple method to estimate the 'noise' exposure in equivalent sound level for combination of different sorts of music has been developed.”62


“Minnesota Orchestra members (42 males, 18 females) aged 24 to 64 years, all asymptomatic for hearing problems or ear disease, were evaluated with a hearing history questionnaire, otolaryngologic examination, and pure tone audiometry for the conventional (0.25 to 8 kHz) and extended high frequency (9 to 20 kHz) ranges. Hearing sensitivity was examined with respect to musician instrument type, years of playing, and orchestral stage position. Type of instrument played and position on the orchestral stage had no significant correlation with hearing loss.”63


“Sixty members of the Minnesota Orchestra (aged 24 to 64 years) and 30 nonmusicians (aged 20 to 69 years) were evaluated for hearing sensitivity within the conventional audiometric


62 E. Jansson, and K. Karlsson, abstract for Pubmed record number 6648318.

63 D. W. Johnson, et al., abstract for Pubmed record number 4095488.
range (0.25 to 8 kHz) and within the extended high frequency audiometric range (9 to 20 kHz). Threshold data were evaluated by age, sex, and musician- nonmusician categories for the respective frequencies, and data were compared to other studies. Musician hearing appeared no poorer than nonmusician hearing, suggesting no major hearing loss from musicians’ exposure to orchestral noise. Hearing acuity of the two groups was similar to some normal groups reported in the world literature but appeared poorer in comparison to some normal groups defined by a very restrictive definition of normal hearing. Issues relating to the definition of normal hearing are explored. A mathematical model descriptive of the extended high tone hearing sensitivity for musicians and non-musicians evaluated was calculated. The formula is presented from which typical age-specific extended high frequency thresholds may be calculated for the 90 subjects evaluated.


“Pure-tone audiometry was performed on 140 classical orchestral musicians employed at the Gothenburg Symphony Orchestra and the Gothenburg Opera in Sweden. This report is based on the results from hearing threshold measurements, presented as median audiograms according to gender, age group and instrument group. The results did not show severe hearing losses that could be attributed to exposure to musical noise. However, the study reflects the subjects’ present hearing ability status and does not give an answer to the question of future hearing dysfunction. Female musicians were shown to have significantly better hearing thresholds in the high-frequency area than did male musicians. Furthermore, the median pure-tone hearing thresholds for the male musicians displayed a notch configuration at 6 kHz in the left ear, similar to that of noise-induced hearing loss. A small, but in general not significant, difference was detected when comparing the median hearing thresholds between each instrument group. Percussion and woodwind players displayed slightly worse hearing thresholds than did other musicians. Players of large string instruments had the best hearing threshold values. When comparing age groups and gender it was noted that the median hearing thresholds were stable and within 20 dB HL up to the age group of 40-49 years for both females and males.”


“Using pure tone audiometry in 1995, a hearing reassessment was made in 56 classical musicians who participated in Axelsson & Lindgren's study 16 years earlier, in 1979. This study focuses on hearing development in these classical orchestra musicians, active in Göteborg, Sweden. The aim of the study is to evaluate the risk of progressive hearing loss during work in a classical orchestra. Another aim is to study possible hearing differences in females and males and to compare the high frequency pure-tone average values found in the study with two normal materials. The main findings were that the male, compared to the female musicians, showed a tendency toward a more pronounced, although not significant, hearing reduction in the high frequency region and higher threshold distribution within the 90th percentile than the females. This was found most often in the left ear. The median audiogram for all females showed a notch configuration at 6 kHz, compared to the males who had a high-tone sloping configuration. When comparing high frequency pure-tone average (HFPTA) values with ISO 7029, the females are

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64 D. W. Johnson, et al., abstract for Pubmed record number 3963693.
distributed around the ISO 7029 median and well within the 90th percentile. The average among the males was equal with the median. Comparison with Davis normal population “all the sample, overall occupational group” showed a more even distribution of the HFPTA values around the median for both females and males on both occasions. This follow-up study showed no extended negative progress of the pure-tone hearing threshold values in spite of an additional 16 years of musical noise exposure.”


“The purpose of the study was to determine how and when the personnel of the Finnish National Opera are exposed to noise and whether exposure depends on musical selection of repertoire. Additionally, an evaluation of sound exposure level due to individual rehearsals was included. The measurements were done using individual noise dosimeters and fixed-point measurements. From the measurements, annual noise exposure in the Opera was evaluated. The conductors, dancers, and double bass players were exposed to levels below 85 decibels, A-weighted, dB (A), which is the national action level. The choir members were exposed to sound levels of 92 and 94 dB (A). Within the orchestra, the highest sound exposure levels were found among percussionists, 95 dB (A); flute/piccolo players, 95 dB(A); and brass players, 92-94 dB(A). Other sound exposure levels among orchestra members varied from 83 to 89 dB (A). Soloists and rehearsal pianists are likely to be exposed to sound levels exceeding the national action level. From an exposure perspective, the individual rehearsals, 79-100 dB (A), proved to be as important as performances and group rehearsals, 82-99 dB (A), among orchestra musicians and choir singers. The ambient sound level for the lighting crew was 76 +/- 4 dB (A). However, the measured sound levels at the ear varied from 77 to 92 dB (A) due to the communication via headphones that had individual volume control. For the majority of personnel of the Finnish National Opera, sound exposure level exceeded the national action level value of 85 dB (A). Artists exceeded the action level during both individual and group rehearsals, as well as during performances. Hearing protection has been designed for musicians. Education/reinforcement is required to ensure it is worn.”


“Classical musicians are often exposed to sound levels that exceed the Finnish national action limit value of 85 dB (A). Still, the use of hearing protectors is uncommon among musicians. The purpose of this study was to find out musician's attitudes towards hearing protectors, and under which conditions hearing protectors are used. The study group consisted of five major classical orchestras in the Helsinki region. The players were asked to fill out a questionnaire with questions on hearing protection, ear symptoms, including tinnitus, hearing loss, pain in the ears, and temporary ringing in the ears. Also, questions concerning stress and working environments were asked. Of those who responded, 94% were concerned about their hearing to some degree. Only 6% of the musicians always used hearing protector devices (HPDs). Self-reported hearing loss was quite common, with 31% of the musicians reporting some hearing loss. Temporary tinnitus was even more common at 37%. There were 15% of

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67 H. M. Laitinen, et al., abstract for Pubmed record number 12573963.
women, and 18% of men reporting permanent tinnitus. Hyper-acousis was reported by 43% of
the musicians. The ear symptoms affected the usage rate. Hearing protectors were used more
often among musicians having ear symptoms (20%) than those reporting no symptoms (6%).
Further, the 43% of the musicians found their work to be interesting and meaningful. Stress was
experienced to some extent by 60%, and musicians with ear symptoms had three to nine times
more stress and felt their working environment noisier. The study shows that musicians seldom
use hearing protectors before symptoms begin. Symptoms increased usage rate, but the usage
levels are still far from ideal. Motivation and training is needed to improve hearing protector use
among musicians.  


From measurements of noise levels at five rehearsals with the City of Birmingham Symphony Orchestra, it is estimated that the high noise levels will result in approximately 15% of
orchestral musicians losing 26dB or more at age sixty-five. The sum of the measurements are
deceiving in that in the rehearsals where the level of noise was above the 90dB occupational
exposure standard, the noise level was not sustained for a complete eight hour work day. This
allows the high noise levels to pass inspection. However, these readings were taken from the
front of the stage to absorb all of the instruments. It is highly likely that musicians sitting directly
in front of loud instruments are at a far greater risk of hearing loss. Specifically, sound levels
taken around horns, trumpets, and bassoons exceeded 90dB by at least 5dB. String players are at
a lesser risk. In short, trumpet and piccolo players are exposed to levels of sound that exceed the
safe maximum occupational sound exposure level.

Low frequencies are less damaging than high frequencies. This accounts for the
relatively lower risk factor for percussionists, as their loud instruments typically generate lower
frequencies. The piccolo player, for example, is at a much greater risk.

Brass instrumentalists, including trumpet players, are in a high-risk group, and strings are
in the low-risk group. Coping strategies include offsetting louder works with softer pieces,
and the use of Plexiglas baffles placed in front of trumpet players to shield the musicians in front
without disrupting performances visually or audibly.

Obeling, L., and T. Poulsen. “Hearing Ability in Danish Symphony Orchestra

“The audiograms of fifty-seven musicians from four Danish symphony orchestras were
determined in connection with an interview about their working experience. Measurements of
sound levels and noise dose were performed during rehearsal and during concerts in the four
orchestras with the measurement equipment placed in various instrument groups. The average
audiogram showed a decrease at higher frequencies similar to an age-related hearing loss. Each
audiogram was corrected for the age of the person by means of the median from ISO 7029 and
the average audiogram from these age-corrected individual audiograms showed no signs of
hearing loss. The audiograms were also compared to the expected audiograms from ISO 1999,
which takes account of the number of years at work, the number of playing hours per week, and
the average sound level in the orchestra for the instrument group. In almost all cases the
measured audiograms looked better than the predictions from ISO 1999. It may be concluded
from this investigation that musicians cannot be expected to get pronounced audiometric hearing

68 H. M. Laitinen, abstract for PubMed record number 16053602.
losses from playing in a symphony orchestra. It should be noted, though, that the data material is limited, and that the subjects have not been selected in a systematically or representative way."\(^{69}\)


“Symphony orchestra musicians from The Royal Danish Theatre (15 females and 80 males) aged 22 to 64 years were audiologically examined to elucidate the presence and the frequency of noise-induced hearing loss among classical musicians. Compared to a reference material (ISO 7029) the median hearing thresholds of the musicians were increased for all age groups. When using hearing sensitivity in one or both ears less than 20 dB HL as a criterion for normality, it was found the 58% of the musicians had a hearing impairment. 50% of the males and 13% of the females showed a typical audiogram with a notched curve at higher frequencies normally attributed to occupational noise exposure. Furthermore, a significantly poorer hearing on the left ear was found at higher frequencies among the violinists. It is concluded that symphonic musicians suffer from hearing impairment and that the impairment might be ascribed to symphonic music.”\(^{70}\)


“Hearing is of special vocational importance in musicians. Musical performance may create sounds sufficiently intense to cause sensorineural hearing loss. Although such losses are usually not severe enough to be compensable under American Academy of Otolaryngology guidelines for occupational hearing loss, they may interfere with the musician’s ability to perform the daily tasks of his or her profession. A review of the literature on occupational hearing loss in musicians reveals a substantial need for further research.”\(^{71}\)


“Although industrial and recreational noise have been recognized as potential causes of noise-induced hearing loss for quite some time, it is only recently that the sound levels within a symphony orchestra have been implicated as possible sources of harmful noise levels. Many studies have concluded that not only are dangerous levels of noise present within the symphony orchestra, but there is evidence of noise-induced hearing loss among symphony orchestra musicians. Although hearing protection designed for industrial use may not be appropriate for the special listening needs of professional musicians, recent advances in hearing protection design have made hearing protection practical for this population. Suggestions are made for monitoring and protecting the professional ear.”\(^{72}\)

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\(^{69}\) L. Obeling and T. Poulsen, abstract for *Pubmed* record number 12689507.

\(^{70}\) B. Ostri, et al., abstract for *Pubmed* record number 2609103.

\(^{71}\) R. T. Sataloff, abstract for *Pubmed* record number 2053603.

\(^{72}\) P. U. Teie, abstract for *Pubmed* record number 9448410.

“Tips for preventing permanent noise-induced hearing loss (NIHL) are presented, including: (1) have hearing checked by a licensed audiologist at least once a year, (2) avoid hazardous sound environments whenever possible, (3) utilize hearing protection devices whenever possible. A study found that approximately half of musicians tested had hearing loss above an acceptable level. On orchestra stages, a so-called "sound shield" or "baffle" can provide some degree of protection from the loudest sections. A sidebar discusses hearing protection devices.”


“Tinnitus is a ringing in the ears that often follows loud noise exposure. For some performers, tinnitus is only temporary, but for others, the damage can become permanent. The causes and treatments of tinnitus are detailed.”


“Noise-induced hearing loss (NIHL) is well reported among devotees of rock ’n’ roll music, but less attention has been focused on players of orchestral music. Sound pressure levels have been recorded from within orchestras during performances, and audiometry has been carried out on orchestral musicians. Short-lasting peaks of sound of high amplitude were found to occur, and some players had audiometric changes consistent with NIHL. However, in practice, there seemed to be no threat to the players' continued livelihood, although the additive effect of presbyacusis in later life poses a potential problem. The difficulties of prevention of NIHL and the attenuation of the high sound levels of orchestras do not seem to be completely soluble.”


“Objectives: Prior to this study, it was not clear how familiar orchestral musicians were with the various insertable models of hearing protectors. The present study focuses on musicians and entertainers and proposes the maintenance of a noise exposure limit through the use of a hearing protector. Materials and Methods: This study was conducted by distributing a questionnaire to musicians (n = 429) in nine orchestras in order to obtain information on the use of hearing protection and the musicians' hearing sensitivity. Results: Hearing protectors were found to be seldom used by orchestral musicians. During orchestral rehearsals, < 1/6 of the test persons used Type 1 (individually fitted) hearing protectors although> 80% of the respondents indicated that they knew about them. A gap emerged between what seemed most important to musicians in hearing protectors and what was provided by the manufacturers. Conclusions: The

73 Abstract for *IIMP* record number 00376439.
74 Abstract for *IIMP* record number 00314336.
75 G. A. Westmore, and I. D. Eversden, abstract for *Pubmed* record number 7316860.
subject of hearing protection in orchestral musicians should be investigated with a multidimensional approach which considers the following in equal measure: legal regulations, the requirements and limits of the music sector and the individual characteristics of the musicians involved."\footnote{Zander, Spahn, and Richter, abstract for Pubmed record number 18270404.}

Zembower, Christian M. “Caution: Music can be hazardous to your health.” \textit{Update: Applications of Research in Music Education} 18, no. 2 (Spring-summer 2000): 8-11.

“Addresses music-related hearing loss. Hearing protection and modifications to the environment are discussed."\footnote{Zembower, abstract for RILM record number 2000-56804.}
MULTIPLE MEDICAL DISORDERS

A number of studies in the field of trumpet playing and medical problems discuss two or more medical problems within the same publication. Therefore, this potpourri of sources does not fit well in one particular subsection of this bibliography, as each subsection is devoted to a unique medical area. Rather than repeating each of these sources in every subsection of this bibliography, these important sources are listed alphabetically by author here.


“Discusses the various types of job-related illnesses of professional musicians, including pain syndromes, focal dystonia, the lip and tooth problems of wind and brass blowers, and the internal effects of playing wind and brass instruments. Concludes that professional musicians are subject to a multitude of physical and psychological conditions that can result in both acute and chronic complaints.”


Playing wind instruments with excessive pressure may lead to stroke, particularly among trumpet players. This is due to the amount of high stress exerted on the blood vessels when trumpet players blow into their instrument. The pressures from the neck and chest can affect the blood vessels in the brain and cause them to rupture. It is likely that professional musicians eliminate extra pressure through technique and otherwise have a greater tolerance for playing high-resistance wind instruments. However, though the risk of strokes is present for trumpet players, it is highly unusual.


The earliest record of the diagnosis of musicians’ disorders was in 1713 by Bernardino Ramazzini. Musicians are still susceptible to the same disorders today because of the demands of

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78 Eckart Altenmüller, and Maria Schuppert, abstract for IIMP record number 00174838.
playing professional music. This can be attributed to personality traits and physical characteristics of playing instruments. Musicians are often perfectionistic and put their art before their own health and physical condition. Most musicians do not get paid unless they play, allowing little time for much needed rest. It stands to reason that they also do not have the luxury to take time off from work to recuperate and seek treatment. Depending on the instrument, many musicians’ bodies can actually become deformed to better anatomically fit the instrument after years of playing.

4,025 musicians were surveyed from the International Conference of Symphony and Opera Musicians. Of the 2,122 respondents, 76% report at least one medical condition that negatively affects their performance. 36% reported having four different severe problems. The most common ailment among musicians is overuse syndrome with a prevalence of 50% among professional musicians. Although there is no objective test or diagnostic criteria for overuse syndrome, the chief symptom is pain. Brass instrumentalist are next to the least affected instrument family, followed by percussionists.

Another common ailment is TMJ disorders. This is reportedly most prevalent among trumpet players, violinists, violists, and lower brass players. In the case of brass players, the TMJ disorder is caused by displacement of the mandible in forming the embouchure, disturbing the natural occlusion and related muscles. Studies show that trumpet players must bend their knees and straighten their lumbar lordosis to reach higher notes. This postural change is proportionate to the amount of upper jaw overbite. The overbite causes a lowered horn angle because the surfaces of the teeth of the upper and lower jaw are not even. Depending on the horn angle created by the player’s anatomical structure, the trumpet player is required to compensate with posture changes to a greater or lesser degree.


“‘The effects of anthropometry (the science that deals with the measurement of the size, weight, and proportions of the human body) on body posture of trumpeters playing in a standing position. Sixteen virtuosi trumpeters were photographed while hitting three notes (low c, high f, and high f sustained) during performance of musical tasks. Earlier results showed that the musical task had no effect on playing posture. The importance of anthropometric variables in playing the more demanding notes indicate that anthropometry may act to constrain the trumpeter’s performance.’”


“The following contributions are cited separately in this volume of *RILM:* Jochen Blum, Thomas Mastroianni, and Richard N. Norris, Musikschulen und -hochschulen und ihre präventiven Aufgaben bezüglich zukünftiger Erkrankungen bei Musikern [Music schools and colleges and their task in preventing future diseases among musicians] (95-11798); Jochen Blum, Streich- und Zupfinstrumente [Bowed and plucked string instruments] (95-11804); Jochen Blum and J. Ahlers, Verletzungen und Rehabilitation [Injuries and rehabilitation] (95-11812); Jochen Blum and Jürgen Rudigier, Diagnostik, konservative und operative Therapie [Diagnosis, and whether or not to operate] (95-11818); G. Bork, Dermatologische Erkrankungen und Allergien

There are numerous characteristic skin symptoms that are common in musicians and are usually harmless marks of their profession. There are, however, many less frequent and more serious skin diseases that are due either to mechanical irritation and other physical noxae or to allergic and non-allergic contact reactions. Professional musicians can be affected by other skin diseases that cause serious problems and ultimately put an end to their career. This applies especially to lip diseases in woodwind and brass players.


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The epidemiology and risk factors for performance-related medical problems are discussed. Differing populations of musicians are also examined with attention to specific risk factors, including: music students, professional orchestral musicians, non-classical musicians, marching and other band members, amateur musicians, the male and female genders, and differing age groups. In addition, the epidemiology and risk factors are assessed by instrument, including the brass family. Dermatologic, psychological problems, the effects of substance abuse, and hearing problems are also summarized.
The instrument itself plays a role in the epidemiology of a musician’s injuries. The contributing risk factors involving the nature of instruments include: the posture sustained for playing, the weight of the instrument, the pressure of the instrument at the contact points of the player, the nature of the repetitive motions used while playing, and the physiological demands of the instruments, i.e., breath control.

The primary musculoskeletal risks encountered in brass players involve the facial musculature that makes up the embouchure. Postural problems involving the upper torso, neck and shoulders are also reported. Lip problems of brass players may be mechanical, traumatic, infectious, neural, or allergic. The allergy to nickel, the primary metal in mouthpieces, is not uncommon.

There is no evidence that the HIV virus can be transmitted through saliva. Other infections can be transmitted on the mouthpiece itself. These include herpes, the common cold, and other bacterial or spirochetal infections.


This article addresses the medical problems that a woodwind or brass musician may encounter. No published English abstract exists for this source. For more information, see RILM record number 1995-11806.


Of the two hundred and twenty-seven trumpet players surveyed, 53% report having one or more musculoskeletal problems related to playing trumpet. These injuries had a higher prevalence in the right-hand fingers, wrist and shoulder. In addition, headache, blackout, hearing loss, and loss of embouchure control are serious concerns resulting from the physical demands of trumpet playing.

The musical symptoms of trumpeters with dystonia are: poor tone quality, problems with articulations, and impaired lip control. The physical manifestations of over-use and soft-tissue damage include discoloration, pain and swelling. This source is also found in ITG Journal 28 (October 2003): 61.


The prevalence rates and the severity of the medical problems of brass musicians vary according to the specific demands of each instrument. The side of the body affected is specific to
the side of the body that positions the instrument, causes the proper compression against the lips, stabilizes the horn, and manipulates the valves or slide. In trumpet playing both hands stabilize the horn and position it securely against the embouchure. The right hand operates the valves. It is the right side fingers, hand, wrist, forearm, elbow, shoulder, side of neck, side of upper back and lower back that have a high prevalence rating of medical problems.

76% of the brass musicians are males with 4.11 years of college music experience, who practice 2.5 hours a day and exercise 3.5 hours a week. 61% of the brass players in this study report one or more musculoskeletal problems. Among the brass instruments, trumpet players report the lowest prevalence rate of having one or more musculoskeletal problems at 53%.

The prevalence ratings in many cases are more than twice as high in females. 25% of female trumpet players report having right hand problems. Males report 10.6% having right hand problems.

The prevalence rating of blackouts, dizziness, headaches, and loss of lip control are highest in trumpet and French horn players. This shows the correlation between the physical demands of playing at higher frequencies which require higher intraoral pressures and mouthpiece forces.


The majority of medical problems of the embouchure of horn players can be divided into two categories: overuse injuries, and focal dystonia. The cause of the repetitive injury disorder of the embouchure is simply the repeated excessive pressure of the mouthpiece against the lips. This causes fluids, primarily the lymph channels to leak into the interstitium (the connective tissue spaces between the cells). It takes extended periods of time for this fluid to drain, much like getting a fat lip from a hit to the lips. The stiffness caused from the swelling often triggers the musician to practice more to achieve the desired musical result, and the problem perpetuates. Pain and discomfort are typical of this injury. Treatment for this type of disorder requires cessation of playing for a period of time depending on the severity of the problem.

Focal dystonia is a task-specific kind of dystonia that is characterized by involuntary muscle contractions of a particular region. There are two main focal dystonias affecting musicians: focal hand dystonia, and focal embouchure dystonia. Neither type is accompanied by pain or discomfort. Both types of dystonias are disorders of the brain, not of the muscles and tissues involved. The symptoms do not manifest themselves until the player performs the task-specific (focal) movement. Trembling of the lips and air leaking from the lips while playing are common symptoms of focal dystonia of the embouchure. There is a low prognosis of improvement or cure for patients suffering from dystonias.


“Thirty-eight musicians, evenly divided between woodwinds and brass, underwent cardiological, opthamological, stomatological, and ear-nose-and-throat examinations. Notable differences were revealed between the two groups. Despite the fact that brass players drank more
coffee and smoked more, the woodwind players tended to have higher blood pressure. The use of anti-stress medication was considerably higher among woodwind players, as was the incidence of superficial lip problems such as cracking, drying, and formation of callouses. Brass players, however, suffered more from dizziness, heart palpitations, and functional dystonias.\textsuperscript{82}


“Spontaneous spinal epidural hematoma (a blood clot in the spine) is an uncommon clinical entity. A typical case is presented with a review of appropriate differential diagnosis and management.”\textsuperscript{83}


“Central to working effectively with young musicians’ medical problems are proper diagnosis and treatment, followed closely by rehabilitation of the affected area of the body. Even more important is prevention. All music educators must be aware of their students’ potential for developing medical difficulties and have a layperson’s working knowledge of their causes, contributing factors, basic diagnostic elements, and principles of treatment and rehabilitation. Three major factors play into the development of overuse-related problems: (1) participating in any activity that exceeds the body’s physiological limits; (2) misuse, such as improper technique; and (3) the genetic condition known as hypermobility or double-jointedness. Pain is the primary symptom that something is wrong.”\textsuperscript{84}


This book examines the structure and function of the musician’s anatomy. Various medical concerns are addressed, including the following: overuse injuries, tendonitis, tenosynovitis, Carpal tunnel and other nerve problems, arthritis, hand injury, and treatment alternatives.


“In a paper first presented as part of a symposium held in Aspen, Colorado in 1984, Professor Farkas delivers an eloquent explanation of maladies common to brass players. The discussion goes into some detail about problems related to embouchure, breathing apparatus, holding the instrument, and the psychology of stage fright. His article is particularly useful for

\textsuperscript{82} Catherine Daubine-Coulombez and Helene Vigroux, abstract for \textit{RILM} record number 99-10492-ap.
\textsuperscript{84} William J. Dawson, abstract for \textit{IIMP} record number 00484771.
the medical professional because it includes an explanation of the performance elements affected by each disorder discussed.”


“Selected musicians with tension myalgia were taught muscle control using electromyographic (EMG) biofeedback techniques [with] ongoing visual and/or auditory computerized display of their muscle activity during various tasks. A baseline profile was recorded from several muscles, including the trapezius, frontalis, and forearm extensor muscles, first at rest, during a mental arithmetic stressor, and during internally visualized recollections of pleasant or unpleasant experiences. Recovery to baseline after these episodes, the "let-go" rate, was of diagnostic importance, with rapid let-go indicating quick adjustment to new circumstances. Many players showed abnormally high levels of muscle contraction; in one patient with focal dystonia, the level was 20 times above normal. Training and home practice of biofeedback reduced these levels.”


“The skin is important in the positioning and playing of a musical instrument. During practicing and performing there is a permanent more or less intense contact between the instrument and the musician's skin. Apart from aggravation of predisposed skin diseases (e.g., atopic eczema or psoriasis) due to music-making, specific dermatologic conditions may develop that are directly caused by playing a musical instrument. METHODS: To perform a systematic review on instrument-related skin diseases in musicians we searched the PubMed database without time limits. Furthermore we studied the online bibliography "Occupational diseases of performing artist. A performing arts medicine bibliography. October, 2003" and checked references of all selected articles for relevant papers. RESULTS: The most prevalent skin disorders of instrumental musicians, in particular string instrumentalists (e.g., violinists, cellists, guitarists), woodwind players (e.g., flautists, clarinetists), and brass instrumentalists (e.g., trumpeters), include a variety of allergic contact sensitizations (e.g., colophony, nickel, and exotic woods) and irritant (physical-chemical noxae) skin conditions whose clinical presentation and localization are usually specific for the instrument used (e.g., "fiddler's neck", "cellist's chest", "guitar nipple", "flautist's chin"). Apart from common callosities and "occupational marks" (e.g., "Garrod's pads") more or less severe skin injuries may occur in musical instrumentalists, in particular acute and chronic wounds including their complications. Skin infections such as herpes labialis seem to be a more common skin problem in woodwind and brass instrumentalists. CONCLUSIONS: Skin conditions may be a significant problem not only in professional instrumentalists, but also in musicians of all ages and ability. Although not life threatening they may lead to impaired performance and occupational hazard. Unfortunately, epidemiological investigations have exclusively been performed on orchestra musicians, though the prevalence of

86 Mariella Fischer-Williams, abstract for RILM record number 99-13125-ap.
instrument-related skin conditions in other musician groups (e.g., jazz and rock musicians) is also of interest. The practicing clinician should be aware of the special dermatologic problems unique to the musical instrumentalist. Moreover awareness among musicians needs to be raised, as proper technique and conditioning may help to prevent affection of performance and occupational impairment.”


“Performance of a wind instrument requires appreciable lung volume and diaphragmatic mechanical force, skilled breath control, adequate patency and humidity of air passages, and precise coordination of the oropharyngeal cavity. Depending on the instrument class, variable rates of air flow, pressure, and duration are necessary to produce optimal tone quality. Wind players may be seriously impaired by respiratory diseases that, comparatively, might appear trivial to the nonperformer. The workplace environment should be assessed for occupational hazards when managing these patients, and smoking should be particularly discouraged. Controversy exists implicating wind instrument use in the exacerbation of respiratory disease, including bronchial, laryngeal, pharyngeal, and oral anatomic changes—a result of the constant barotrauma of performance. Asthma is the most common chronic pulmonary disorder among wind players, and therapeutic programs that include breath training and physical exercise improve symptoms, endurance, and general well-being.”


“The aim was to determine the incidence of tinnitus, impaired hearing and musculoskeletal disorders among musicians and the relation to the number of practicing hours and/or the instrument type before the onset of symptoms. METHOD: The study base consisted of students enrolled in the School of Music and Music Education at Göteborg University between the years 1980 and 1995. There were 407 of the 602 original students that answered a questionnaire (response rate of 68%). The questionnaire concerned exposure before and after the enrollment in the Music Academy, as well as onset of symptoms. RESULTS: The highest incidence of symptoms was found for reported tinnitus with a rate of 10.6 per 1000 years of instrumental practice. There was a relationship between exposure to the number of hours of instrumental practice and incidence of impaired hearing. Among the musculoskeletal symptoms the highest incidences per 1000 years of instrumental practice were pain in the neck and in the left shoulder with a rate of 4.4 and 4.6 disorders per 1000 years of instrumental practice, respectively. There was 2.4 times higher incidence for musculoskeletal disorders in the right hand/wrist and a 2.2 times higher incidence in the left elbow/forearm for musicians who practiced for 20 h or more per week before the onset of disorders compared to those who practiced fewer than 20 h per week when controlling for age and gender. Musicians with a violin or a viola as the main instrument had four times the incidence for right elbow/forearm disorder and twice the

87 Thilo Gambichler, Stefanie Boms, and Marcus Freitag, abstract for Pubmed record number 15090069.
88 T. B. Gilbert, abstract for Pubmed record number 9448412.
incidence of neck pain, pain in the right shoulder and the left elbow/forearm compared to those who had piano as the main instrument.”


As the title suggests, this symposium discusses the medical problems of brass players and treatment options. No published English abstract exists for this source. For more information, see RILM volume 29, entry number: 16032.


This book covers many aspects of trumpet playing and instruction. The dental considerations and medical conditions that may harmfully affect trumpet playing are discussed.


“Musculoskeletal problems are common in instrumental musicians. Most of these problems can be classified as musculotendinous overuse, nerve entrapment/thoracic outlet syndrome, or motor dysfunction. Also seen in musicians are problems related to hypermobility and degenerative arthritis. Although these problems are seen in all instrumentalists, their prevalence is highest in professional musicians, with string players most commonly affected by musculotendinous overuse. Keyboard players are the performers most commonly affected by motor dysfunction. History and physical examination performed with an understanding of the problems of musicians are usually adequate to make the correct diagnosis. Electrophysiological studies are often helpful in confirming or excluding a diagnosis of nerve entrapment. With the exception of motor dysfunction, once these problems are recognized, they can be adequately treated. Treatment should begin conservatively with rest, evaluation of technique and practice habits, and possibly nonsteroidal anti-inflammatory drugs. Depending on the type and severity of the problem, physical therapy, adaptive devices, steroid injection, or surgery may be indicated. A strong partnership with music educators is important in the management and prevention of these musculoskeletal problems.”


Of 2212 orchestra members surveyed, 75% report having at least one medical problem severe enough to hinder their performance. String players report the highest incidence of medical problems.

89 M. Hagberg, G. Thiringer, and L. Brandström, abstract for Pubmed record number 16028091. 90 Richard A. Hoppman, and N. A. Patrone, abstract for Pubmed record number 2683092.
problems, and percussionist account for the fewest. Brass players, both amateur and professional, have significantly lower prevalence rates than string players, woodwind players, or keyboardists. The most common injuries are overuse-related, entrapment neuropathies, thoracic outlet syndrome, focal dystonia, hypermobility, and Osteoarthritis.


The most common types of musicians’ injuries involve the overuse of muscles in a repetitive fashion, prolonged weight bearing of the instrument in unnatural positions, dermatologic irritation, peripheral neuropathies, focal dystonias and otolarynologic disorders. Trumpet players are no exception. Trumpet players with nickel allergies will react to their mouthpieces with eczema symptoms in the mouthpiece area of the lips. Gold or plastic mouthpieces are a common solution. Brass players are also predisposed to lip muscle injury due to the high stress of playing high and loud for extended periods. Rupturing of the orbicularis oris (Satchmo’s Syndrome) is an example of this that is most prevalent among trumpet players because of the high pressures needed to play the instrument.

Neurological disorders may also result from trumpet playing. These include transient ischemic attacks, embolization, and spontaneous cervicothoracic epidural hematoma—all due to the high internal pressures of playing brass instruments. Otolaryngologic disorders of trumpet players include: stress velopharyngeal incompetence (leaking of air through the nose) and laryngoceles.


“Surveys of performing musicians indicate that almost half of them experience playing-related medical problems, some of which threaten or end their careers. Overuse injuries involving the muscle-tendon unit are the most common problem, with symptoms ranging from mild pain while the musician is playing to pain severe enough to preclude any use of the affected hand. String players are the most commonly affected, and percussionists the least. The most important predisposing characteristic is the use of repetitive movements during long hours of practice, but awkward body positions mandated by the shape and weight of the instrument, the technical difficulty of the repertoire, and unfamiliar instruments may also play a part. Women are more commonly affected than men. Rest is the cornerstone of therapy. Neural impingement syndromes affecting the median or ulnar nerves or the thoracic outlet affect many musicians. Focal dystonias may involve part or all of a hand or the muscles forming the embouchure (the position of the lips in wind players). These are very resistant to therapy and may terminate or drastically alter a career. Stress, especially performance anxiety, may impede performance. Beta-adrenergic blocking agents prevent the symptoms of performance anxiety and are frequently used by musicians without medical supervision. A recognition of the unique problems of musician-patients has led to the formation of successful specialty clinics in a number of cities.”


91 A. H. Lockwood, abstract for Pubmed record number 2643048.
“In order to define a standard diagnostic protocol for managing allergic diseases in musicians, we conducted a literature search on this topic. The most frequent allergic disease in this special category of workers was contact dermatitis, always described in stringed and wind instruments players, involving the mouth and the hands. No other allergic disease directly related to musical instruments was reported. The most frequently reported culprit substances were: colophony, exotic woods, nickel sulphate, varnishes, and propolis (bee glue). Thus, being contact dermatitis the most frequent disease, a correct diagnostic approach to this problem in musicians should involve, in addition to clinical history and examination, the patch test with a specific panel of substances. Finally, allergy in musicians involves additional problems: the virtual impossibility to avoid the offending substance, and the poor adherence to therapy due to lifestyle. In general, this specific allergologic problem seems to be underestimated, under diagnosed and, as a consequence, poorly managed.”


“The authors examined the relationship between perceived occupational stress and the prevalence of a number of psychologic and physical ailments in a sample of professional symphony orchestra musicians and related musicians’ self-reports of stress to demographic and occupational characteristics. Results of a survey of 2,212 musicians from 47 symphony orchestras revealed a significant relationship between perceived occupational stress and prevalence of a number of psychologic as well as physical medical problems. Age and occupational factors, such as the orchestra in which the musician plays, the instrument played, and status as a soloist, were also found to be significant correlates of perceived stress.”


“The physiological aspects of brass instruments playing and the health problems encountered by performers are discussed. Exercises and techniques for addressing these problems are suggested.”


Playing the trumpet is physically demanding and requires training of certain muscle groups. In addition, the physiology of the trumpet makes it vulnerable to certain ailments of the lips, mouth and respiratory tract. This includes the following: parotiditis (infection of the parotid gland), pharyngocoeles (herniation of the pharynx), laryngocoeles (herniation of the larynx), syncope (transient dizziness or passing out), and facial dystonia. Despite these rare possibilities, trumpeters continue to strive through medical problems for the sheer joy of the music.

92 C. Lombardi, et al., abstract for Pubmed record number 12674039.
93 S. E. Middlestadt and M. Fishbein, abstract for Pubmed record number 3183784.
94 Francisco Mercado, José Manuel Miñana, and José Ricardo Salom, abstract for RILM record number 2000-43846.

“Arts medicine has come of age, resulting from 3 important developments over the past decade: [improved] methods of diagnosis and treatment, an awareness that artists suffer from special problems related to their occupation and lifestyle, and the establishment of health programs emphasizing an interdisciplinary approach to these patients. We focus on the patterns of illness afflicting [performing] artists, specifically dancers, singers, actors, and instrumental musicians, and explain some of the [options the] health care team can do in treating these patients. The conditions governing these patients' lives[,] exposure to high expectations of excellence, incessant demands for perfection, long periods of intense practicing, fierce competition, high levels of anxiety associated with performance, and unce careers--need to be understood. Levels of disease and disability are remarkably high, but artists often ignore symptoms. We discuss the musculoskeletal, neurologic, vocal, psychological, and other syndromes found among performers and some of the difficulties in treating them. The prevention of injury, conservative management, collaboration with teachers, and a psychotherapeutic approach are desirable. Arts medicine programs for professional consultation exist in several major cities of the United States and abroad. Although research is needed regarding the effectiveness of health care [service] for performing artists, the scientific literature devoted to this field is growing.”


“Discusses the results of a small survey of health issues among wind and brass players. The problems reported include pathologies of the lips, tongue, palate, larynx, teeth, and breathing.”


This article elucidates common medical problems related to playing a brass instrument, particularly the horn. No English abstract exists for this source. For more information, see RILM record number 1995-04742.


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86 Emmanuelle Pégurier, abstract for RILM number 1999-10473.
Musicians place great physical demands on their bodies to perform complicated movements at often high rates of speed for long hours. These stresses are complicated by the awkward playing position of various instruments, improperly sized instruments that create too large a reach for the player, the demand for long endurance, flaws in technique or posture, and a psychological desire to please the conductor or audience at all costs.

Women are more frequently injured than men. Of 4,025 members of the Conference of Symphony and Opera Musicians surveyed, 76% report having had one or more injuries severe enough to hinder performance. Lifestyle traits of musicians may contribute to this, such as hectic performance schedules and long rehearsals and practice routines.

In the case of wind players, muscle fatigue can contribute to self-inflicted wounds. As the embouchure tires, musicians often try to compensate with excessive muscular contraction to maintain the same flow rate of air. This type of tension impairs performance and is potentially damaging.

Strategies for coping with the athletic demands of instrumental music include modifications in the practice routine to allow time for rest, posture and technique modifications, warming-up properly, and heeding the warning signs of pain. The most universal prevention is ample rest. Another, extra-musical solution is the application of time-management strategies.


“The unique occupational dermatologic disorders of musicians are reviewed and compiled to provide the clinician with a reference list. Our results were obtained by a survey of 24 members of a professional symphony orchestra. The results of the survey revealed a significant incidence of occupationally related skin problems in musicians.”

Additional comments are found in: *Journal of the American Academy of Dermatology* 24 and 25, nos. 2 and 5 (February-November, 1991), as follows: Vol. 24, no. 2: 321-2, Vol. 24, no. 4: 665, and Vol. 25, no. 5: 870.


Out of 9,795 questionnaires distributed to professional conservatories, music schools, orchestras, music groups, “cobles” (traditional Catalonian bands), and associations of professional musicians, 1,639 were returned and completed. These reports show brass players having 85.5% incidence of medical problems relating to their music. Furthermore, this survey ranks the prevalence of injury in brass players the second highest, contrary to American surveys. Among the brass players who responded, 77.1% report cervical discomfort. 48.4% report having discomfort in the area of the mouth and embouchure. The incidence of musicians’ injuries was significantly higher in all cases among professional musicians.


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97 S. Rimmer, and R. L. Spielvogel, abstract for *Pubmed* record number 2138638.
The author discusses several music-related health issues that can wreak havoc on a musicians career or hobby: (1) Nutrition; (2) Environmental Issues; (3) Repetitive Strain Injuries; (4) Musculoskeletal; and, (5) Psychological and Neurological Injuries.


“This self-directed learning module discusses classic topics and highlights new advances in this topic area. This article, which discusses upper-limb injuries in musicians, is a section of the study guide on sports and performing arts medicine in the Self-Directed Physiatric Education Program for practitioners and trainees in physical medicine and rehabilitation. This article uses case vignettes to elaborate on issues relating to musicians. OVERALL ARTICLE OBJECTIVE: To summarize overuse injury, nerve entrapment, and focal dystonia in instrumental musicians.


“A questionnaire answered by professional classical musicians in the Rhône-Alpes region of France showed a predominance of musculoskeletal disorders in string players, and buccal-dental and auditory disorders in wind and brass players. The results may be used to draw conclusions as regards a more organized and effective response to the health problems of orchestral musicians, and above all as regards prevention strategies.


“We began our specific interest in this subject in 1975 and to date have seen and treated over 600 musicians with functional problems of the upper limb. These are common problems affecting over one third of instrumental musicians. Every instrument may have its own specific repercussions. However certain factors may influence their onset: intensive practice; a technique requiring non-physiological positioning; a change in technique, instrument or habits; pre-existing trauma; psychological predisposition; inappropriate physique. The presentations are varied and the limits imprecise. Muscles, tendons, joints and nerves may be involved. The commonest, and easiest to cure are due to pain resulting from overuse syndromes cover a multitude of sins resulting from marked physical effort in excess of the normal physiological capacity of the body. Joint instability and degenerative disease pose their own specific problems. Peripheral nerve lesions can be related to overuse syndromes or to the adoption of non-physiological or harmful positions. The most difficult problems to deal with are those related to a loss of motor control when performing the same repetitive movement-functional dystonia. Their origin remains obscure with the major discussion revolving around either a neurological or organic aetiolog.
Our intensive experience of instrumentalists with these problems secondary to bad positioning or posture, has led us to propose a therapeutic regime based on structured re-education and relaxation. The great majority of sufferers overuse syndromes or functional dystonias have been able to resume their professional activities. It is clear that functional dystonias are curable if treatment is instituted early and that the lesions are not too long standing."\(^\text{101}\)


This article surveys the various medical problems of instrumentalist musicians, with special consideration to the causes and prevention. No published English abstract is available for either source. For more information see _RILM_ record number 1995-03143-1.


“Occupational diseases, work-related diseases and occupational stigma in professional musicians are discussed. Predominant diseases and symptoms related to various organic systems, such as musculoskeletal, neuromuscular, respiratory system, skin, mouth and teeth diseases, as well as the effect of noise and psychological stress, have been listed. The preventive measures in order to promote health of musicians are described in particular.”\(^\text{102}\)

\(^{101}\) R. Tubiana, and P. Chamagne, abstract for _Pubmed_ record number 8353774.  
\(^{102}\) E. Zuskin, et al., abstract for _Pubmed_ record number 12812021.
NERVOUS DISORDERS

The nervous disorders of trumpet playing typically fall into two categories: task-specific embouchure dystonia and compression nerve damage, (i.e., carpal tunnel syndrome). However, several significant articles were found that do not fit into these two categories. There are a few studies on transient ischemic attacks\(^{103}\) (i.e., a “mini” stroke with no lasting damage), and sensory loss of the lips\(^{104}\) secondary to trumpet playing. Another interesting study examines the improvement of both “horn stuttering” and speech stuttering simultaneously through speech therapy.\(^{105}\) Two other studies discuss Bell’s palsy (facial paralysis) and trumpet playing.\(^{106}\)

Interestingly, this bibliography reveals the progression of understanding of the etiology of focal dystonia from the early hypotheses linking dystonia and over-practicing to the present generally accepted belief that dystonia is a brain disease whose onset is without a specific precipitating damage. This debate continues in research coming out of the twenty-first century. As recently as 2005, Spanish physicians, Rosset-Llobet, et al., claim that focal dystonia is a result of overuse.\(^{107}\) The most recent research argues, however, that dystonia occurs due to alterations in the normal cortical topography of the brain, (i.e., abnormal plasticity of the increased central connections via somatosensory

\(^{103}\) Stefan Evers, Henning Henningsen, and E. Bernd Ringelstein, “Transient Ischemic Attacks Caused by Trumpet Playing,” *Neurology* 51, no. 6 (December 1998): 1709-10.


In other words, with practice, the fluidity of movements needed in music performance is made possible through “shortcuts” in the cortex. In some musicians, focal dystonia occurs as a brain disease in which these “shortcuts” cause involuntary movements in the “focalized” activity. Another branch of research shows that peripheral trauma can induce focal dystonia. What remains to be clear is whether intense practicing would function as “trauma” and initiate focal dystonia in the embouchure.


This entire journal volume of Advances in Neurology collects articles on dystonia from Vol. 20, 1978 to Vol. 93, 2003. This important resource is cited here as both the book collection of journal articles and by individual author of articles on dystonia as they relate to trumpet. Chapter five is specifically dedicated to the study of “Musicians’ and Other Focal Dystonias.”


“This article reviews the neuroanatomic and neurophysiologic foundations of music performance and learning. Music performance is regarded as complex voluntary sensorimotor behavior that becomes automated during extensive practice with auditory feedback. It involves all motor, somatosensory, and auditory areas of the brain. Because of the life-long plasticity of neuronal connections, practicing a musical instrument results first in a temporary and later in a stable increase in the amount of nerve tissue devoted to various component tasks. Motor and somatosensory brain regions corresponding to specific subtasks of music performance are larger in musicians starting younger than age 10 years than in the general population. In rare cases, overuse of movement patterns may induce a degradation of motor memory that results in a loss of voluntary control of movements, called musician's cramp. Specific therapeutic options for this condition are reviewed.”

110 Eckart Altenmüller, abstract for Pubmed record number 12945651.

“Nerve compression syndromes are common in the general population, and they are also common in musicians. As many as 30% of musicians who have a recognized musculoskeletal disorder are diagnosed with a nerve compression syndrome. Thus, it is important to consider the diagnosis of nerve compression syndromes in all musicians who present with musculoskeletal complaints. Proper management of these problems is essential if one is to avoid significant morbidity.”


“The chapter discusses the demographics, manifestations, treatments, and effect on playing and on the careers of 113 musicians diagnosed with focal dystonias and followed for 1 to 12 years.”


“Instrumentalists were diagnosed as having focal dystonias over a ten-year period in a performing arts medicine clinic. The data for all patients are shown in tabular form, and the implications of the data are discussed. The patients, male and female, consisted of woodwind, keyboard, string, brass, and percussion players. Eleven wind and brass players' dystonias affected the muscles of the embouchure; the other 47 patients' dystonias affected the muscles of one or more fingers of one hand. The vast majority of these musicians were professionals, and many carried the extra responsibility of teaching appointments. Of particular interest were eight patients who noticed the onset of dystonia after attempting to make dramatic technique changes. However, although these eight patients and many others reported contributory factors or precipitating events for their dystonias, 19 could report no such precipitating event.”


“This book presents the fundamental aspects of the classification, etiology, and differential diagnosis of this uncommon neurologic condition and provides a summary of the genetics and neurophysiology of dystonia. The remaining focus is on the practical aspects of nonmedical, medical, surgical, and chemodenervation therapies. Relevant to the office-based

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111 P. C. Amadio, abstract for *Pubmed* record number 12852670.
113 Alice G. Brandfonbrener, abstract for *RILM* record number 1997-07340.
presentation of dystonia, additional breadth is provided covering management considerations for each of the focal dystonias and dystonia-related conditions.114


The expression, “killing your nerve,” is a misnomer for focal dystonia, or “Horn-player’s Palsy.” This condition is often linked to a specific injury or physically demanding performance. Treatments have been largely ineffective at this evasive disorder. Attempts at treatments to date include: Botulinum-Toxin-A, a neurotoxin, injected into the perioral muscles to calm the tension, and the use of drugs that ordinarily treat Parkinson’s disease. In addition, homeopathy and acupuncture have been reported as treatments with similarly unpredictable results.


“Musicians' cramp is known as focal dystonia. One common type of focal dystonia to affect musicians is focal hand dystonia. In this disorder, involuntary co-contractions of the flexor and extensor muscles create abnormal postures of the fingers, thumb, and wrist. Current evidence of the cause of focal hand dystonia supports a model of aberrant or excessive neural plasticity due to intensive and repetitive practice of fine movements of the fingers and hand. Once a pattern is well-learned and established, successful remediation requires retraining the brain. Behavioral retraining may be supplemented with appropriate medications to minimize muscle spasms.”115


“A functional assessment of the musician presenting a dystonia is of the utmost importance since the rehabilitation strategy is based largely on the outcome of the assessment. The evaluation deals largely with the musician's physical condition, but the psychological profile and morphology must not be overlooked. The physical examination must be performed methodically and is based on observation, palpation, and tests of the spine, pectoral girdle, arms, hands, and the musician's standing and sitting positions while playing. During the physical examination, the explanations given by the therapist and the exchanges with the musician form the basis for a confidence-based relation essential to establishing and pursuing the rehabilitation.”116


115 Nancy Byl, abstract for IIMP record number 00507706.
“Proprioceptive and exteroceptive sensitivity constantly guides the gestural movements of musicians. Rehabilitation is based on the results of complete functional analyses and on proprioceptive reprogramming in several phases. This type of rehabilitation is slow and requires active participation on the part of the musician. Psychological support is necessary as well.”


“We studied the effects of botulinum toxin injections in eighteen patients (14 men and 4 women) with musician’s cramp, which is a focal dystonia of the hand that interferes with performance. Improvement was judged by the patient. Botulinum toxin produced focal weakness in every patient in at least one injection cycle. With the best injection cycle, seven patients had major improvement in musical performance, six had moderate improvement, and two had minor improvement; three had no response to the treatment. The mean total duration of improvement was 11.8 ± 8.6 weeks. The mean follow-up period was 14.6 ± 12.8 months. During this time, thirteen patients who had initially responded to treatment withdrew from the study because of insufficient response (ten patients) or subsequent failure of the botulinum toxin to produce weakness (three patients). Two of the latter patients demonstrated antibodies against botulinum toxin type A. Despite the initial improvement in many of the patients, only a few have found the injections of sufficient benefit to continue with treatment.”


The conditions for dystonia are often due to faulty musical training, specifically, tension in players’ technique. In order to resolve dystonia, the musician must retrain and relearn how to move tension-free. In some cases, the patient can spontaneously resolve the dystonia through movement therapy, such as the Alexander Technique. Mental imagery can assist this sensory-motor dysfunction. Effective imagery during retraining and relearning can be recalling a time when the affected area worked normally, reminding oneself how easy it was to do the task, and using freely moving, fluid musicians as models for recovery. Feedback on this article is found by: Estrin, Glen, and Steven Frucht. “Feedback: Dystonia: Separating Fact from Fancy.” *International Musician* 100 (August 2002): 3.


The preliminary signs of focal dystonia in brass players often occur in one register. Technical passages may become strangely difficult or resistant. Following these initial signs, performance problems worsen and neither increased practice nor time off seems to help. No pain is experienced. Brass players are usually affected in the corners of the mouth and jaw.

117 Philippe Chamagne, abstract for *RILM* record number 2001-03774.
Symptoms only occur while playing. These may consist of tremors in the embouchure. Muscle function therapy, including massage therapy and acupuncture, most often do not provide relief as this is a disease of the brain. There are no successful known therapies for treating focal dystonia.


Dystonia is not related to overuse; rather, it is a brain disorder. It is a disease of the brain. Over three hundred case studies show there are no specific triggers.


“Nerve compressions are really quite common, especially those involving the hand and upper extremity; nothing has been discussed in this presentation about problems arising from the lower back (and entirely separate subject). The performer’s awareness of the causes and symptoms produced by nerve compression is crucial to the effective, early evaluation and treatment of such conditions. Most of these can be treated effectively without surgery; however, when it’s necessary, nerve decompression offers the possibility of significant recover of hand and upper extremity function and return to performance.”


Focal dystonia belongs to a larger family of conditions called occupational palsies, such as writer’s cramp. Over-practicing has been implicated as a contributing factor. There is generally no family history of focal dystonia. Neurologists and neurophysiologists have not determined the exact disease process. Some scientists’ research has shown that the brain perceives the shape and composition of the hand differently in patients with dystonia.

Embouchure dystonia is more common in brass players than in double reed instrumentalists. Symptoms usually onset in the musician’s thirties or forties, are more common in professional players than hobbyists, and affect more males than females.

Treatment options are limited. Botox injections treat the symptoms by weakening the contracting muscle. A new treatment (for focal dystonia of the hand) involves immobilizing the affected areas with splints, known as constraint therapy. Cognitive and psychological techniques have also been attempted, though focal dystonia is rarely cured. Prevention through careful practice habits are the best advice in the absence of a cure.


Contrary to Barbara Conable’s article, “How to Resolve Dystonias: A Movement Perspective,” dystonias are not caused from practice habits or ungraceful playing movements. Though dystonia may follow injury, it is more commonly slow and subtle in its onset. Dystonias are first and foremost a disorder of the brain and must be treated by a neurologist.


The symptoms of musicians’ focal dystonia in musical terms are: increasing loss of control, specific tasks, such as legato playing in brass instrumentalists, are only affected, and a sense of weakness in the involved muscle area. The disorder is usually painless, without numbness or tingling. For brass instrumentalists, embouchure problems develop, making sustaining notes difficult and visible involuntary pulling of the corners of the mouth. Increased rest or practice does not affect the slow decline in performance. Playing the instrument triggers the muscle spasms that are not present when at rest.

Dystonia is a disorder of motor control that begins in the brain. Presently there is no cure, though treatments are available. Injections of botulinum toxin may help deaden the nerves of the over affected muscles; however, it will not allow musicians to regain the control needed to completely regain their former playing level.


Brass playing may cause transient ischemic attacks (cerebral embolization) in young players with a right-left cardiac shunt. The rate of microembolic signals in brain-supplying arteries increase during trumpet playing and Valsalva maneuver, and can be detected with a transcranial Doppler. The increased intrathorasic pressure associated with trumpet playing likely causes an increased rate of right-left cardiac embolization in young patients. This type of embolization has strong evidence to prove the subsequent effect of cerebral embolization.


The author discusses a historical perspective on dystonia, with the first known diagnosis in 1830 (writer’s cramp). Dr. Frucht then addresses the following questions: what is the prevalence for TSFD in musicians?; who is at risk?; what triggers TSFD?; is music performance a risk factor for developing dystonia?; why does TSFD affect the hand?; and how should affected musicians manage their disease? Musicians who are patients with TSFD are unique in that for a treatment to be effective, it must grant nearly 100% recoveries for professional performances to resume. The Dystonia Medical Research Foundation offers more information at: www.dystoniafoundation.org.


“Focal task-specific dystonias are unusual disorders of motor control, often affecting individuals who perform complex repetitive movements. Musicians are especially prone to develop these disorders because of their training regimens and intense practice schedules. Task-specific dystonia occurring in keyboard or string instrumentalists usually affects the hand. In contrast, there have been few descriptions of musicians with task-specific dystonia affecting the muscles of the face and jaw. We report detailed clinical observations of 26 professional brass and
woodwind players afflicted with focal task-specific dystonia of the embouchure (the pattern of lip, jaw, and tongue muscles used to control the flow of air into a mouthpiece). This is the largest and most comprehensively studied series of such patients. Patients developed embouchure dystonia in the fourth decade, and initial symptoms were usually limited to one range of notes or style of playing. Once present, dystonia progressed without remission and responded poorly to oral medications and botulinum toxin injection. Patients with embouchure dystonia could be separated by the pattern of their abnormal movements into several groups, including embouchure tremor, involuntary lip movements, and jaw closure. Dystonia not infrequently spread to other oral tasks, often producing significant disability. Effective treatments are needed for this challenging and unusual disorder.”


“First described by Gowers over a century ago, examples of focal task-specific dystonias (FTSDs) include telegrapher's cramp, writer's cramp, golfer's cramp ("the yips"), and musician's cramps. By definition, FTSD affects one part of the body exclusively during the performance of a specific task. FTSD may be the first sign of a generalized dystonia, before spread to other tasks or other parts of the body. However, in the overwhelming majority of patients with FTSD, dystonia remains confined to the body part and the specific task in which it started.

There is considerable debate regarding the role of peripheral trauma in triggering dystonia. Cervical dystonia, shoulder dystonia, and dystonia of the arm and leg have been reported following local trauma. Recent work in primates and humans supports the idea that FTSDs may result from alterations in normal cortical topography. Although the etiology of these disorders is unknown, the idea has been proposed that in a susceptible population, FTSD may be triggered by peripheral trauma.

We report two unusual patients, both musicians, who developed FTSD after peripheral trauma. In both instances, dystonia was temporally and anatomically linked to the peripheral injury. Although the trauma was not severe, dystonia was professionally debilitating, and in one case continued to progress long after the trauma had healed.”


“Musicians are subject to a high rate of occupational injuries, including overuse syndromes, nerve entrapments, and focal task-specific dystonias. Relatively few examples of musicians with task-specific dystonia of the oral-facial region have been reported. We present two French horn players with task-specific dystonia and demonstrate an interesting technique for retraining oral musculature.”


120 S. J. Frucht, et al., abstract for Pubmed record number 11746620.
124 Yoshihiro Hirata, et al., abstract for Pubmed record number 15073521.
Many brass players may have been misdiagnosed or dismissed by medical professionals when they in fact had embouchure dystonia. Dystonia is a painless, but repetitive involuntary movement or contracting of muscles. The onset of dystonia in musicians usually occurs between twenty and forty years of age.

Embouchure dystonia can be musically detected by a gradual decline in performance quality, air leaks in the corners of the mouth, especially in the upper register, and an unsteady tone in legato passages. It is often difficult to reproduce the dystonia without actually buzzing the mouthpiece, making it very difficult to diagnose.

There is no cure presently for any form of dystonia. There are no treatments for embouchure dystonia specifically. “Botox,” or Botulinum Toxin, is given for focal dystonia; however, the weakening of the muscles is impairment in brass performance in and of itself.


No published English abstract or original Russian title is available in the available databases. In light of the published English title, this article appears to discuss a case report of a trumpet player with facial paralysis. For more information, see Pubmed record number 6526321.


“Embouchure dystonia is a focal task-specific disorder involving abnormal non-coordinated movements and involuntary muscle contraction around the mouth. In professional brass players it is often so disabling that patients have to limit or give up their occupation. We examined the somatosensory homuncular representation and measured gap detection sensitivity of the lips in eight former professional musicians affected by embouchure dystonia and eight control subjects. Relative to controls, the patients’ digit, and especially the thumb, representations were shifted in a lateral direction towards the lip representational zone. Patients’ upper lips showed decreased sensitivity compared to their lower lips (p < 0.01). This asymmetry result was absent in controls. Abnormal somatosensory reorganization may contribute to the disorder.”


“Chronic overuse of the arm or fingers results in movement disorders. In particular, repetitive motion can result in upper extremity ‘dystonias’. These are painless contractions that hinder smooth repetitive movements of the involved digits or limb. As a result, patients present with twisted appendages or unusual posture. This review aims to elucidate these dystonias and separate them from peripheral nerve entrapments, tenosynovitis, epicondylitis, and arthritis. The
appropriate diagnosis provides the basis for proper medication, muscle restrengthening and botulinum toxin injections.\textsuperscript{125}


“The purpose of the study was to develop a method to quantitatively and qualitatively describe the activity of selected muscles of the embouchure in French horn players using surface electromyography (EMG). Also, the reliability of several dependent variables that may be useful in future studies of embouchure dystonia (ED) was assessed. Five volunteers, including four normal French hornists (two male, two female) and one performer with ED performed two standardized tasks on two different occasions. The first task consisted of playing four iterations of two notes, one that elicited tremor in the ED subject and one that did not. This was followed by a 60-sec fatigue trial on the nontremor note. The levator labii and depressor anguli oris muscles were instrumented with miniature surface electrodes, and a microphone within a mute allowed audio signals from the horn to be simultaneously recorded. The presence of tremor was uniquely identified in the ED subject using EMG, and continuous wavelet transformation scalogram comparisons indicated temporal differences in signal power (pV\textsuperscript{2}/Hz) as well as in the dominant frequency range. Within-trial reliability for amplitude, mean and median frequency, zero crossings, and power was excellent (r > 0.977) for both muscles on the first performance task. Between-session reliability ranged from fair to good (r ~ 0.677-0.898) on these same variables. Numerous other variables associated with the fatigue task also showed good to high reliability (r \cdot 0.90-0.99) between testing sessions. The findings suggest that the simple testing protocol presented may be of use in future studies of ED.\textsuperscript{126}


Iltis’ attempt to improve his low register horn playing by extensive practice sessions made his playing worse. He was eventually diagnosed with focal dystonia of the embouchure. Though the exact cause of dystonia is unknown, trauma may induce dystonia and excessive practicing may increase the likelihood as well. Practice sessions should include five minutes of rest every thirty minutes with breaks every ninety minutes.


were investigated by means of a questionnaire focusing on different anxiety disorders and were compared with healthy musicians (n=30) and musicians with chronic pain syndromes (n=20). Musicians with focal dystonia more often reported social phobia and specific phobias than did healthy musicians. Musicians who later developed focal dystonia more often suffered from specific phobias than musicians who later developed chronic pain. Musicians with chronic pain more often reported free-floating anxiety compared with healthy musicians. In the stage fright subscale, no significant differences were observed between the groups. The patterns of specific phobias and social phobia were reported to have existed before the onset of dystonia.127


Musicians are subject to a number of treatable medical problems, such as over-use syndrome, tendonitis, and nerve entrapment. One medical problem remains elusive: focal dystonia. The epidemiology of dystonia in musicians has not been well studied. The five categories of dystonia are: focal, multifocal, segmented, hemidystonia, and generalized dystonia. Focal dystonia is accompanied by a blepharospasm, oculogyric deviations, oromandibular and lingual dystonia, torticollis, foot dystonia, and task dystonia, such as writer’s cramp.

The etiology of focal dystonias in musicians is classified as peripheral and central. Peripheral dystonias are caused by nerve entrapment and overuse injuries in combination. This disorder manifested itself in the upper lip and fingers respectively in the trumpeters with focal dystonia in this study. Possible causes include peripheral trauma through overuse, nerve entrapment, change of technique or instrument, genetic predisposition and unusual emotional stress. Other research suggests that task specific focal dystonia possibly results from abnormal sensory feedback to the supplementary motor area of the brain.

Treatment begins with a proper diagnosis. Rehabilitation includes resting, the use of ice, nonsteroidal inflammatory agents, topical 10% trolamine sicylate (Aspercreme), stretching and strengthening exercises, and the correction of faulty technique. Anticholinergic drugs, carbamazepine, propranolol, primidone, diazepam and tetrabenazine may be used on musicians with idiopathic or inherited focal dystonia.


“A 42 year-old professional horn player began to experience marked tightness of lip and facial muscles only when he played the French horn. Eventually performing, but not teaching, had to be discontinued. Routine therapies were ineffective, but bromocriptine (an antiparkinsonian agent) was effective. A daily dose enabled him to resume his orchestral career. A second horn player presented similar problems and similar results from the same therapies. Questions regarding occupational palsies are discussed.”128


128 Marc David Horowitz, “Horn Citations in Recent Medical and Scientific Literature,” The Horn Call 28, no. 3 (May 1998): 59.
This chapter discusses the phenomenology of dystonia, tracing its known history with a detailed bibliography of milestone research from 1887 to 1988, differential diagnosis, classifications of dystonia, biochemistry, animal models of dystonia, etiology of dystonia and management for those affected by dystonia.


“Observation of the rehabilitation process of musicians with focal dystonia has resulted in the identification of the psychological characteristics shared by these individuals. Feelings of helplessness and loss of a frame of reference predominate; reactions include resignation, rebellion, and a focus on solving the problem. Some qualities that may have played a part in the development of the dystonia--such as reliance on willpower, perfectionism, perseverance, and endurance--may be redirected towards rehabilitation and increase the chances of its success.”


“Over the past 10-15 years, there has been increasing interest in the health problems of performing artists. In this review, I will discuss the major playing-related disorders seen in instrumental musicians. Among the 672 instrumentalists evaluated, the major diagnoses identified included musculoskeletal disorders in 64%, peripheral nerve problems in 22.5%, and focal dystonia in 7%. Sixty percent of instrumentalists were female although males predominate in the group with focal dystonia. The average age of those evaluated was 32 years. Among musculoskeletal disorders overuse syndrome is the most common. Frequent peripheral nerve disorders include thoracic outlet syndrome, carpal tunnel syndrome, and ulnar neuropathy. A characteristic distribution of symptoms and signs is identified for each instrument group. Electrodiagnostic studies are an important part of the evaluation of these disorders. With carefully designed treatment, the majority of instrumental musicians can be returned to full and pain-free playing activities. The success rate is highest in some entrapment neuropathies but remains low in focal dystonia.”


“A twenty-one year old female trumpet player developed a strange tingling sensation of the left side of her upper lip. A short discussion of the signs, symptoms, and assessment of sensory loss of the lips.”


129 Bénédicte Kolle, abstract for RILM record number 1999-13635.
130 Richard J. Lederman, abstract for Pubmed record number 8196698.
Dr. Lederman presents a brief history of dystonia in musicians dating back to 1840 in a pianist, an 1878 in a flutist. The frequency of focal dystonia in musicians is not known as prevalence data is sparse. Individual statistics from doctors are given, and range between 8 and 14%. In addition, in the author’s series, men affected outnumber the women two to one. The average age of onset for the condition was thirty-two years for men and thirty-eight years for women. The clinical symptoms are examined and statistically listed. In brass players, the disorder consistently manifested itself in the embouchure. Finally, the present state of treatment options are listed, and reveal that all options reach only limited success.


“Instrumental musicians often seek medical consultation for symptoms suggestive of nerve entrapment. About 20% of those seen in the author's performing artists' clinic were diagnosed with a focal neuropathy. In general, neuropathies that are most common in the overall population tend also to be most common among musicians, although some expectations exist, including, for example, localized peri-oral sensory syndromes associated with playing a brass instrument, and, possibly, ulnar neuropathies related to the playing position of bowed string players. The diagnosis is made, as always, by careful clinical assessment, including observation of the instrumentalist playing, with ancillary procedures such as nerve conduction studies and needle electromyography adding to the accuracy of the diagnosis. Treatment is similar to that used in nonmusicians, but certain factors, including the musician's requirement for extraordinary neuromuscular dexterity, may influence the therapeutic decisions. Very limited long-term outcome results are available, and additional studies in musicians would be helpful in determining the most appropriate therapeutic approaches. Virtually no longitudinal studies have been performed to look at methods for preventing these disorders.”


“In conclusion, musicians' focal dystonia is a significant and potentially career-ending neurological condition of which physiatrists and other performing arts medicine clinicians should be aware. Pathology has been identified in the somatosensory cortex, and in the motor cortex and basal ganglia. Although advances have been made in the elucidating some of the pathologic changes in focal dystonia, better understanding is needed. Current treatments such as retraining, splinting, oral medications, and botulinum toxin injections are limited. Therefore, the ultimate goal for focal dystonia is to prevent this disabling disorder of instrumental musicians.”


132 R. J. Lederman, abstract for Pubmed number 17097478.
133 T. J. Lie-Nemeth, abstract for Pubmed number 17097479.
“A study compared 2661 healthy musicians from eight German conservatories with 183 patients (154 of them male) with musicians' cramp in an outpatient clinic at the Institut für Musikphysiologie und Musiker-Medizin (IMMM) in Hannover from 1994 to 2000. Comparisons between the healthy and impaired subjects were made by gender and instrumental group (keyboard, strings, woodwind, brass, plucked instruments, and percussion). Results were consistent with earlier studies suggesting that particular instrumental groups were at greater risk of developing musicians' cramp. When gender was not a factor, woodwind and plucked-instrument (guitar) players were more likely to develop musicians' cramp, while those playing string and percussion instruments were least affected. Results for keyboard and brass players were not significantly different than expected. When gender was included in the analyses, the number of male patients with cramp was greater than expected, even when the number of healthy male musicians was accounted for; the opposite was found for female patients. When gender was also included in the instrumental analyses, male musicians were more likely to have musicians' cramp than were female players of keyboard, string, woodwind, and plucked instruments. The only instrument group without a gender bias for symptoms was brass. These results suggest that male musicians are more likely to develop musicians' cramp within certain instrumental groups, and may reflect a general predisposition for male musicians to develop the disorder. The ages at onset were not different for male and female subjects in the sample.”


“Discusses the injection of botulinum toxin to relieve functional dystonias and reports on ten cases of the treatment. About one-half of patients can be helped, with the treatment administered long term in conjunction with a physical retraining program. The benefits of an injection disappear after four to six months. Professional musicians are unlikely to fully regain their technique.”


“Presents seven cases of cervicofacial dystonia in professional wind instrumentalists (four saxophonists, a horn player, a trombonist—all male—and a female flutist). Their mean age was 34 and their symptoms had begun two to four years earlier. The saxophonists presented oromandibular dystonia with different levels of muscular impairment. The horn player suffered from laryngeal dystonia resulting from neuroleptic treatment. The trombonist and the flutist had focal dystonia of the face. After being treated with botulinum toxin injections, all experienced nearly full symptomatic relief and all resumed playing, but only one (the hornist) was able to resume his professional career. Avoidance of sudden changes in technique and overly intensive playing are suggested as preventive measures, along with early treatment of neuromuscular malfunctions.”

135 Marie-Hélène Marion, abstract for RILM record number 1999-12623.
136 Marie-Hélène Marion, et al., abstract for RILM record number 1999-13632.
Massing, W. [The Horn Player and Ockham’s Razor.] (German) Psychiatrische Praxis (Germany) 25, no. 4 (July 1998): 204-5.

No English abstract or un-translated title exists for this German source. The journal’s title and subject are in the field of Psychiatry, though the Pubmed database lists related items with the subject of dystonias. This suggests that the article is focused on the psychological effects of dystonia on the horn player. For more information see Pubmed record number 9738253.


“Presents the case of a 32 year-old male stutterer who also exhibited stuttering like behavior while playing the French horn. Effects of speech fluency targets on the playing and physiological and psychological correlates between the stutter in speech and the stuttering like behaviors when playing an instrument are discussed. A coordination difficulty may have been the common etiological factor underlying the problems in all three areas: speech development, fluency, and musical production. Daily speech therapy in conversation for one month significantly reduced the S’s stuttering in conversation and musical playing.”


“Task Specific Dystonia (TSD) is a subset of action dystonia that occurs exclusively or primarily when the patient is performing a specific task. This particular condition, which may be debilitating, has been described for more than a century. TSD is often reported in musicians and generally affects the hands when playing string, percussion, or wind instruments. There have been case reports of this phenomenon affecting the mouths of players and we describe a case we believe may fall into this category.”


Focal dystonia is an enigmatic condition that puzzles doctors and musicians alike. It is fortunate that this condition only affects 1% of the population of musicians. Focal dystonia is a painless involuntary contraction of muscles while engaged in a focalized, specific task, such as forming an embouchure.

The nature of dystonia contradicts normal muscle fire function. Typically when a muscle contracts, the muscles on the opposite side of the joint relax to free the joint for movement. This is called reciprocal inhibition. In the case of dystonia, co-contraction occurs, in which both sets of muscles fire simultaneously, impeding the intentional movement.

137 Marc David Horowitz, “Horn Citations in Recent Medical and Scientific Literature,” The Horn Call 28, no. 3 (May 1998): 60.
Alexander Technique is often recommended for the player to reexamine musical movements to free themselves from tension. There is no documented evidence of improvements with this technique to date. Presently there is no cure and little understanding of this bizarre condition.


“A 17 year-old French horn player with cold symptoms had intentionally occluded the left external ear canal and blown his nose, rather forcefully, to try to relieve pressure in the right ear. This caused an immediate right sided dropping of the mouth as well as other neurological deficits. Within twenty minutes all deficits had resolved. The author concludes that it is possible that the frequent generation of high pressure associated with playing the French horn potentiated the development of this problem, although the phenomenon described here is different from horn-player’s palsy. Noted that “pneumatic” in the title pertains to respiration. Three references.”


Some performance problems in trumpet playing can be explained by a nervous disorder called a dystonia. This disorder is characterized by involuntary twisting or repetitious muscle contractions. Dystonias are classified by causation, the part of the body affected and by the action that triggers the movements.

Joseph F. Phelps, professor emeritus of trumpet at Appalachian State University, developed a dystonia in his trumpet playing at the age of 49. The musical symptoms included: response problems, articulation misfires, and an unpleasing tone quality, especially on Bb trumpet. His performance on high horns (piccolo and Eb) was not impacted to the same degree. Symptoms continued for several years and the professor no longer was able to play during students’ lessons. Other symptoms of dystonia developed outside of his trumpet playing, such as twitching around the mouth, difficulty in eating and talking. These symptoms were later diagnosed as Oro-mandibular Dystonia and possibly Meige Syndrome. The professor retired from university teaching and stopped playing trumpet for nine months.

“Dystonia is six times more prevalent than Huntington’s Disease, ALS (Lou Gehrig’s Disease), and muscular dystrophy. Fewer than 5% of the 200,000 people afflicted with this disease in the U.S. are correctly diagnosed. Brass players are usually afflicted in the corners of the mouth and the jaw. Playing your instrument triggers the muscle spasms, which are not present when at rest. Over 98% of doctors have never seen a case of Dystonia during the time they practice medicine or while attending medical school. A few years ago, most people with any kind of Dystonia waited six to eight years for a correct diagnosis; today, the average is about two years. A support group has been set up by Steven Frucht, M.D., a specialist in the field, and Glen Estrin, a professional horn player who performed with the Chicago Symphony and Lyric Opera of Chicago before being disabled with this condition.”

139 Marc David Horowitz, “Horn Citations in Recent Medical and Scientific Literature,” *The Horn Call* 28, no. 3 (May 1998): 59.

Polo, J. “[When the Virtuosos Bump into Their Art.]” [In Spanish] *Neurología* (Barcelona, Spain) 20, no. 3 (April 2005): 105-7.

No English abstract is available for this article. The original untranslated Spanish title for this record is also not available in the Pubmed index. For more information, see Pubmed record number 15815944.


Focal dystonia is the most common form of dystonia and is typically task-specific; hence the term FTSD, or focal task specific dystonia. Specific motor tasks, including playing a musical instrument, trigger muscle spasms in performance while leaving other actions unaffected. Musicians are especially prone due to their intense training and life-hours of practice. In the general population, FTSD has a frequency of 1:3,400; however among musicians, the prevalence is 1:200. The cause is unknown, though the amplification of standard mechanisms of brain plasticity may be a factor. This hypothesis relates to Hebb’s dynamic synapse concept in which neuronal connectivity is plastically reorganized in the cortex, as demonstrated by the augmentation of the finger projection areas after repetitive tasks, or with practice. This function may improve performance, but it may also contribute to dystonia. Musicians with FTSD demonstrate greater fMRI activation of the contralateral primary sensorimotor cortex, suggestive of unusually increased central connections. The use of BTx injections is most popular, though often ineffective.


Dr. Rosenthal describes the effects of a pinched spinal nerve (radiculopathy) on a “Big 5” symphony orchestra hornist as pain in the left arm and neck that made holding the horn impossible. The MRI scan was not detailed enough for a diagnosis and a CAT scan myelogram test revealed a pinched nerve in the spine due to a bone spur and triggered by a bumpy go cart ride. A small incision in the neck was made to surgically correct the pinched nerve. The horn player was immediately healed and able to play again in the hospital recovery room. Non-steroidal anti-inflammatory medications, such as Ibuprofen, are useful. Most cervical spine disease of this nature will spontaneously heal within a few months. Patients who are not improved after three months, or who are suffering great pain, are candidates for surgery. The most serious conditions may be prescribed prescription steroidal medication.

The compression of the median nerve where it passes through the narrow carpal tunnel in the wrist (carpal tunnel syndrome) is the most common peripheral nerve problem. Symptoms include pins and needles in the fingers and hand pain. Non-surgical treatment involves the use of a wrist and hand brace. The corrective surgical procedure takes ten minutes to perform and symptoms typically improve the same day.

“Introduction: Focal hand dystonia in musicians due to its rareness and specificity. It has been insufficiently described thus remaining a largely unknown condition. Objective: To describe the clinical characteristics of musician's focal dystonia. Methods and Results: We analyzed 658 musicians' cases seen during the past 4 years in a medical center for performing artists. Of the musicians treated, 86 (13 %) suffered from focal dystonia, 42 % were guitarists, 21% pianists and 6% violinists. Men were more affected than women (7:1). Sufferers reported longer practice times (4.8 hours per day) and were older (33.6 years). In comparison, other pathologies were seen when musicians were younger (26.5 years) and played no more than 3.5 hours per day. Conclusions: Focal dystonia in musicians appear to be the consequence of a long history of intense and repetitive manual work while playing music added to other factors, as for example, gender.”


“Discusses Bell's Palsy, an inflammation of the seventh cranial nerve that produces weakness or paralysis of the facial muscles on one side, and its effect on musicians. States that there is a strong belief that it is viral, and the time span for recovery seems to run from two weeks to three months. Notes that the author currently has Bell's Palsy, and his treatment consists of steroids and anti-viral medication, coupled with daily physiotherapy to electrically stimulate the muscles and a number of facial exercises. States that the goal is to gain some muscle tone while waiting for the nerve to heal itself and once again start generating impulses.”


“Discusses the author's battle with Bell's Palsy, a nerve disorder that causes paralysis on one side of the face. Provides a week-by-week account of the author's recovery of his trumpet-playing skills. Notes that at the end of the first week, he could not even form an embouchure, by the end of the third week, he could barely get to the top of the staff, and throughout the fifth week the high register was still weak and unusable. Mentions playing two gigs during the sixth week and teaching at a jazz camp during the eighth week. States that week ten has brought almost total recovery.”


“The authors present the results of eighty-four musicians with focal task-specific dystonia treated with EMG-guided botulinum toxin injections. Treatment outcome was assessed by subjective estimation of playing before and after treatment and self-rating of treatment response. Fifty-eight (69%) of the musicians experienced improvement from the injections and 30 of 84 musicians (36%) reported long-term benefit in their performance ability.”

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141 Rosset-Llobet, J., et al., abstract for *Pubmed* record number 15815945.
142 Chase Sanborn, abstract for *IIMP* record number 00192368.

Forty-five bowed string and woodwind instrumentalists with a diagnosis of focal dystonia were seen between 1985 and 2001 at the Medical Center for Performing Artists, Cleveland Ohio. Among the string players, eighteen were men and three women. The mean age at onset of the symptoms was thirty-four years; the median age was thirty-one years. Among the woodwind instrumentalists, there were fifteen men and nine women. The mean age of onset of symptoms here was thirty-four; the median age was 32.5 years. Overall, there is evidence for increased risk of focal dystonia among men. Treatments employed by the patients included: abstinence from playing, physical exercise, biofeedback, psychotherapy, body awareness technique, alteration in playing technique, change of instrument, new teacher, slow practice/relearning, medication (anticholinergic, dopaminergic, other), surgery (nerve entrapment), Botulinum toxin, splinting/immobilization, and sensory motor retuning/constraint-induced therapy. For all options of treatment, the results varied from none to moderate improvement. Only five of eleven patients with hand dystonia were able to continue their careers as professional musicians. Five of fourteen professional performing string players were able to remain performers. The rest either changed careers entirely, or began teaching full-time. New treatment options with possible anecdotal success need to be studied: refingering exercises, rebuilding the embouchure, and splint devices with prolonged immobilization for four to five weeks.


“There is currently, no validated objective method available for the quantification of musician's dystonia applicable to different types of instrumentalists. To address this issue, we developed the Frequency of Abnormal Movements (FAM) scale and assessed its intra- and inter-rater correlation and concordance, internal consistency, and responsiveness. We also compared the FAM scale to the arm dystonia disability scale (ADDS) and Burke-Fahn-Marsden (BFM) scale. Eighteen patients with musician's dystonia were videotaped playing their instruments before and after sensory motor retuning therapy. Two raters, blinded to the order of the randomized video segments, independently rated each segment using the FAM, ADDS, and BFM scales. Intra-rater correlation (intraclass correlation coefficient [ICC] = 0.92, Spearman's p = 0.87), concordance (weighted \( K = 0.76 \)), and internal consistency (Cronbach's a = 0.96) for the FAM scale were good. Inter-rater correlation and concordance were better for the FAM scale (weighted \( K = 0.94 \), ICC = 0.96, Spearman's p = 0.90) than for the ADDS or BFM scales (weighted \( K = 0.56-0.57 \), ICC scale = 0.81-0.82, Spearman's p = 0.68-0.76). The decrease in the FAM after 1 week of sensory motor retuning therapy was less likely to be due to chance (\( p = 0.06 \)) than the decrease in the ADDS or BFM scales (\( p = 0.21-0.53 \)). The FAM scale may be useful for clinical and research evaluations of patients with musician's dystonia.”


This chapter defines Musician’s Focal Dystonia, discusses the difficulties and failures of treatments, lists patient characteristics and symptoms, and classifies six stages of severity for this disease.


This chapter presents the frequency of focal dystonia in musicians, a discussion of the instrumentalists at risk of developing focal dystonia, the results of treatments, and a discussion of various case studies.


“Impairments caused by focal dystonia are characterized by loss of control during certain movements, and can assume various forms. The loss is sometimes accompanied by nonpainful muscle spasms. Instrumental musicians were first interviewed about their musical ability (technique, studies, repertoire, amount of practice) and then about the origin and nature of their disorder. Impairments in dystonics are generally progressive, but can arise following a minor trauma. They are associated in particular with intensive musical activity or a change in musical behavior. Cases of a combination of dystonic impairments in a given person or within a single family are rare. Obtaining a careful description of the impairment is extremely important since diagnosis is based upon the patient's account as well as the physical examination.”


This chapter presents a historical perspective on occupational cramps and attempts to elucidate viewpoints on the methodology of diagnosis, treatment, and the pathophysiologic basis of focal dystonias.

145 Raoul Tubiana, abstract for RILM record number 1999-13633.
OROFACIAL DISORDERS

Not surprisingly, most of the medical problems of the trumpeter manifest in the orofacial region. For this reason, this section of the bibliography deals with a wide spectrum of issues. Because the embouchure is the precise point at which the musician and the trumpet meet with considerable mouthpiece pressure and tooth displacement, medical problems can arise.\textsuperscript{146} Many illnesses in this category are directly related to the musculature of the embouchure, such as a ruptured orbicularis oris. Other anomalies may be surprising, for instance, velopharyngeal incompetence (air escaping through the nose due to the high intraoral pressures), laryngoceles and pharyngoceles (herniation of the larynx or pharynx resulting in an inflated neck). Other invaluable research provides dental treatment options for the trumpeter which will not adversely affect trumpet performance. Fortunately, unlike in the treatment of focal dystonia, successful treatments exist in nearly all areas.

Temporomandibular joint disorder, also known by its acronym, TMJ Dysfunction, naturally affects trumpet players because the pressure from the instrument is absorbed in part by this joint. Dowdy’s research below shows that brass performance can “aggravate or perpetuate and in some cases, possibly predispose TMJ Dysfunction.”\textsuperscript{147} Howard lists the following TMJ disorder symptoms: headache, facial pain, neck pain, and otologic pain, particularly involving the muscles of mastication.\textsuperscript{148} Successful treatments include:

\textsuperscript{147} Diane Muench Dowdy, abstract for \textit{Proquest Dissertation Abstracts Online} record number 1353758.
\textsuperscript{148} James A. Howard, “Temporomandibular Joint Disorders, Facial Pain, and Dental Problems in Performing Artists,” in \textit{Performing Arts Medicine}. Edited by Robert Thayer Sataloff, Alice G.
splints, bite plates, nightguards, intraoral appliances, stress management, pain control, anti-inflammatory medication, EMG Bio feedback training and relaxation, and behavioral modification through cognitive therapy.$^{149}$

Trumpet players are also at risk for development of muscle lesions of the embouchure and rupture of the orbicularis oris. Fry warns that this damage can be diffuse or localized- a distinction that warrants very different treatment options.$^{150}$ Papsin, Maaske, and McGrail present a study of ten trumpet players with ruptured orbicularis oris muscles in which nine out of ten had corrective surgery and returned to their previous playing level.$^{151}$ As seen in the following pages, this level of successful repair surgery is bolstered by the work of Spanish surgeon, Jaime Planas. Despite Planas’ successful repair surgeries, Sullivan critiques his choice of an external incision and suggests a mucosal side incision to avoid scarring- an idea that Planas already employed in a secondary surgery on the patient in question.$^{152}$

As introduced above, various medical problems may reveal themselves in trumpet players due to the internal pressures created through blowing a high resistance instrument and in some cases, a congenital incompetent palate. Among these problems in the orofacial region, velopharyngeal stress incompetence and laryngo/pharyngoceles are surprisingly prevalent in trumpeters. Beecher, Conley and Marks suggest palatal exercises for students and amateurs with velopharyngeal stress incompetence, and the

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$^{149}$ Ibid.

$^{150}$ H. J. Fry, “Correspondence: Repair of the Orbicularis Oris in Horn Players,” *Plastic and Reconstructive Surgery* 82, no. 6 (December 1988): 1103.


limitation of corrective surgery to professional musicians. Dibbell’s articles are helpful in describing the surgical procedure which involves the lengthening of the soft palate via the insertion of tissue from the neck to allow a proper seal. In addition, the contributions by Schwab and Schultze-Florey present supportive epidemiological data on this phenomenon.

Bilateral laryngoceles and pharyngoceles are discussed at length by Isaacson and Sataloff, Jones, Nengsu, et al., Stasney, Beaver and Rodriguez, and Ward. Descriptive case studies are presented below by Isaacson and Sataloff, as well as by Nengsu, et al. The article by Stasney, Beaver and Rodriguez is the most comprehensive study listed below, as it presents data on the internal pressures (110 cm H2O at 1,024 Hz) and warns that young trumpet players may not withstand such pressures.

The third largest group of studies found in this subsection of this bibliography presents information on the various dental and periodontal problems of trumpet playing. The two leading researchers in this field are Jack Train and Toshio Nemoto. Train primarily contributes by warning trumpet players to avoid cosmetic dentistry. Selected articles from Nemoto’s recurring column in *Brass Bulletin* were chosen to provide information on specific dental concerns pertaining to trumpet which include the following: neuropathy, irregular front teeth, the effects of over-brushing one’s teeth, disorders of the side teeth and their impact on brass performance, aging and dental

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problems, halitosis, tips for examination of students’ dental problems by teachers, periodontosis, orthodontia, wisdom teeth, and oral hygiene.


This dissertation lists the symptoms of TMJ disorder in trumpet and clarinet players along with their respective epidemiological data.


“A brass player retraces his 10-year search for the diagnosis and treatment of his painful lip problem, which began in 1984 after a period of particularly intensive playing and has caused persistent problems in his playing and professional life.”


“80-90% of the adult population is known to have neutralizing antibodies to herpes simplex virus type 1 (HSV1), of these 18-32% suffer from occasional recurrent herpes labialis (RHL). It is thought that local trigger factors as external traumata, UV-light and chemical stimuli, or systemic factors like fever or common cold, may induce RHL. The aim of the present study was to investigate the frequency of RHL in a military brass band and compare this with the frequency of the disease in a control population of soldiers from the same unit. Both populations were national servicemen aged 19-22 yr. The diagnosis of RHL was based on the presence of herpetic vesicles in the labial region. Of the diagnosed cases, 10% were confirmed by laboratory procedures according to standard methods. The incidence of RHL over a period of 8 months was twice as frequent in the group of brass and woodwind players as in the control group of soldiers from the same military unit. This may indicate that the mechanical trauma to the labial tissue which occurs during playing may cause the increased frequency of RHL in musicians.”


156 André-François Arcier, and Alain Vernay, abstract for RILM record number 1999-10484.
157 P. Barkvoll, and A. Attramadal, abstract for Pubmed record number 3474766.
Stress velopharyngeal incompetence (VPI) is defined as “impaired function of the velopharyngeal mechanism that occurs only under high intraoral pressures as encountered when playing wind instruments.” Intraoral pressures when playing wind instruments can be 125 mm Hg greater than normal speech pressures. A seventeen year old boy had an onset of VPI following a band camp in which he played 8-10 hours a day. Although this is the youngest patient recorded with this unusual condition, his manifestation is consistent with those of trumpet players cited in similar studies. Symptoms of VPI include nasal regurgitation of fluids, hypernasality with speech, and nasal air escape during wind instrument playing.

Surgery is only recommended for a professional musician with this condition. This patient was counseled to cease playing trumpet entirely for one month. At the end of the month, the patient had substantial velopharyngeal competence for speech, but inadequate closure while playing trumpet. After one year, the patient could play the trumpet for thirty minutes before the onset of VPI. Palatal exercises were prescribed and the patient can now play for an hour and a half before nasal air escapes during trumpet playing.


“Reports on research done in conjunction with Gebert's dissertation (cited as RILM 95-10322). Findings indicate that even well-trained brass players induce abnormal motion of the upper incisors while producing their highest and/or loudest tones. Even with relatively slight pressure from the mouthpiece, tooth motion can be very considerable. There is no consistent correlation between the pressure of the mouthpiece against the teeth and the degree of experience of the player (some experienced players maintain relatively high mouthpiece pressure). Metal guards to reinforce the teeth can help to prevent some, but not all, kinds of undesirable tooth motion.”


The most effective and long-lasting dental implants used today, especially for brass players, are conical or screw-type titanium surgically placed in the jaw bone. Research shows that the bone tissues adhere to the titanium, unlike stainless steel or porcelain. The only category of implants recommended for brass players are endosseus osseointegrated titanium implants. These are the only implants which bond to the jawbone, adding increased stability needed to compensate for mouthpiece pressure.

Even so, not all patients are good candidates for this procedure. The procedure itself is done under local anesthesia and the implant takes three to six months to osseointegrate before a

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159 Lothar Borchers, Matthias Gebert, and Till Jung, abstract for RILM record number 1995-03260.
connecting piece is placed into the implant for final restoration. Implants of this design will last a lifetime if well cared for.


Many musicians experience injuries; however, the trumpet is perhaps the most dangerous of all. The only other occupation causing similar medical problems due to the unnaturally occurring intra-oral pressures is glass blowing. These pressures can cause a number of problems including: infection in the salivary due to air leaking into the salivary gland through the duct in the cheek, stress velopharyngeal incompetence, and herniation of the neck.

A “W” shaped cut into the soft palate can lengthen the palate to allow a better and stronger seal needed to endure the high intra-oral pressures of trumpet playing. Tissue from the back of the neck is added to lengthen the palate at this incision up to two centimeters. At present, two surgeries have been performed on musicians- both of whom are playing as well or better than before the surgery. The cure rate is estimated at between 70 and 75%.


“During wind instrument performance the soft palate is responsible for sealing off the nasal air passage and directing the flow of air through the oral cavity into the instrument. In some individuals, the palate may not seal completely against the high intra-oral pressure produced during brass performance, causing loss of range and endurance. A relatively simple surgical procedure can lengthen the palate and strengthen its connecting tissue. Increased range and endurance are reported for two musicians discussed in the paper.”161


“Two professional musicians who played wind instruments developed velopharyngeal stress incompetence which prevented them from generating the high intraoral pressures required to play their instruments. In both cases, we did a V-Y pushback with a superiorly-based pharyngeal flap. At 1 1/2 and two years postoperatively, both patients remain free of velopharyngeal incompetence and are actively engaged in their musical careers.”162


“A conservative estimate of five percent of the population suffers from and seeks treatment for disorders of the temporomandibular joint. Approximately five percent of the wind instrumentalists also experience TMJ pain and dysfunction.

162 David G. Dibbell, abstract for *Pubmed* record number 504488.
A review of the literature was conducted to determine the physical characteristics and basic embouchure techniques associated with successful brass performance as well as how TMJ Dysfunction relates to or interferes with these characteristics. The symptoms and treatments of TMJ Dysfunction and how they affect the brass player were discussed.

The research indicated that brass performance can aggravate or perpetuate and in some cases, possibly predispose TMJ Dysfunction in brass players. In addition, the symptoms of TMJ Dysfunction, particularly facial muscle pain, disc interference and limited range of motion, can affect the brass player. The relative advantages and disadvantages of irreversible and reversible treatments were also discussed.


“A healthy mouth with intact functional oral tissue is essential to the wind instrumentalist. Since perioral pressures from playing wind instruments can cause tooth movement and increase muscle tone, orthodontic consultation should be considered when selecting instruments for young players. Maintaining the integrity of the dental arches through regular dental examination, preventative dental procedures, the use of lip shields, bonding materials, replacement prostheses, and splinting and supporting mobile teeth can circumvent loss of tooth structure, malpositioning of teeth, unnecessary tooth extraction, and loss of soft tissue. Complete dentures usually prevent playing; however, improved denture retention methods offer hope for continued playing. Xerostomia and oral cancer are potential problems that become more likely with age and are especially serious for the wind instrumentalist.”


“Discusses the diagnosis and treatment of the 16-year-old instrumentalist who suffered a relapse after his initial treatment. It is concluded that simple thoracic drainage is not a sufficient treatment for wind players. Immediate thoracoscopic treatment is urged in such cases.”


“Focal task-specific dystonias are unusual disorders of motor control, often affecting individuals who perform complex repetitive movements. Musicians are especially prone to develop these disorders because of their training regimens and intense practice schedules. Task-specific dystonia occurring in keyboard or string instrumentalists usually affects the hand. In contrast, there have been few descriptions of musicians with task-specific dystonia affecting the muscles of the face and jaw. We report detailed clinical observations of 26 professional brass and woodwind players afflicted with focal task-specific dystonia of the embouchure (the pattern of lip, jaw, and tongue muscles used to control the flow of air into a mouthpiece). This is the largest

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163 Diane Muench Dowdy, abstract for *Proquest Dissertation Abstracts Online* record number 1353758.
165 Gérard Frecon, and Alain Habrard, abstract for *RILM* record number 1999-13625.
and most comprehensively studied series of such patients. Patients developed embouchure
dystonia in the fourth decade, and initial symptoms were usually limited to one range of notes or
style of playing. Once present, dystonia progressed without remission and responded poorly to
oral medications and botulinum toxin injection. Patients with embouchure dystonia could be
separated by the pattern of their abnormal movements into several groups, including embouchure
tremor, involuntary lip movements, and jaw closure. Dystonia not infrequently spread to other
oral tasks, often producing significant disability. Effective treatments are needed for this
challenging and unusual disorder.”

Fry, H. J. “Correspondence: Repair of the Orbicularis Oris in Horn Players.” Plastic and
Reconstructive Surgery 82, no. 6 (December 1988): 1103.

Dr. Fry makes distinctions to damage of the orbicularis oris according to the nature of the
injury: localized or general/diffuse. Dr. Fry has seen wind instrumental musician patients whose
chief complaint was radiating pain of both lips, suggesting asymmetrical, general damage. Dr.
Planas’ successful treatment of a ruptured orbicularis oris inspired this surgeon to look harder for
symptoms which would suggest a localized rupture. This distinction is significant as surgery may
successfully treat localized damage, while it would not be effective in cases of diffuse damage.

Gratsinskaia, L. N., and G. A. Kirikova. “[Case of Occupational Paralysis of the Facial
Muscles in a Trumpet Player.]” [Article in Russian] Gigiena truda i

This journal is published in Russia and ceased publication in 1992. No English abstract
is available. For more information, see Pubmed record number 6526321.

Guyot, Jean-Francois. “Pressions de l'embouchure sur les levres des trompettistes en
fonction de leur technique instrumentale.” [The Impact of Embouchure on the
Lips of Trumpet Players and How This Relates to Their Instrumental Technique.]
Medecine des arts: Approche medicale et scientifique des pratiques artistiques
(Montauban, France) no. 8 (June 1994): 11-13.

“'Flat tongue' playing is compared to the "no pressing" technique (with the tongue
applied to the palate). A study of mouthpiece pressure on the lips reveals notable differences
between these techniques, particularly a maximal pressure of 3 kg in the first case and 0.5 kg in
the second. The latter technique may help prevent lip and dental problems in trumpet players.”

Howard, James A. “Temporomandibular Joint Disorders, Facial Pain, and Dental
Problems in Performing Artists.” In Performing Arts Medicine. Edited by Robert
Thayer Sataloff, Alice G. Brandonbrener, and Richard J. Lederman, 99-135. 2nd

TMJ disorders elicit the following symptoms: headache, facial pain, neck pain, and
otologic pain. The muscles of mastication are the primary source of facial pain. Therapy should
focus on prevention, and changing the technique of the musician when appropriate.

166 S. J. Frucht, et al., abstract for Pubmed record number 11746620.
167 Jean-Francois Guyot, abstract for RILM record number 1999-10475.
Physical therapy and anti-inflammatory medicines will treat most TMJ disorders. Changes in the dental occlusion are irreversible, expensive, and unnecessary. Splints, bite plates, and “nightguards” can be effective in positively affecting muscle and joint pain. These devices also reduce night teeth grinding, facial pain, and headaches.

Other treatments include: intraoral appliance, stress management, pain control and behavioral modification through cognitive therapy. EMG Bio feedback training and relaxation skills have been effective during the day, but patients can continue to grind their teeth at night. Psychosocial stressors must be considered as factors in the cause of TMJ as well.

At present, current knowledge of this subject is insufficient. Physicians ought to take an active role in the documentation of new cases, and the coordination of treatment with physical therapists, occupational therapists, and mental health providers. These medical professionals must understand the special problems associated with musicians by communicating with musicians and their teachers.


“We report the case of a 16-year-old trumpet player who was referred for an otolaryngologic consultation after his band leader noticed that a neck mass would protrude while the boy was playing. X-rays revealed the presence of bilateral laryngoceles, and computed tomography demonstrated bilateral, air-filled outpouchings of the laryngeal sacules during forced expiration. There was no evidence of any other intra-laryngeal or cervical pathology. Surgery was deferred while the laryngoceles remained reducible and asymptomatic, and the boy was cleared to continue playing.”


“A puffed out neck in brass performance is a troublesome condition called, laryngocele. A pouch resulting from a protrusion of the laryngeal mucosa through a weak spot in the thyroid membrane above the laryngeal cartilage (voice box), this condition is usually harmless. It results from high pressure in the larynx and is correctable with a surgical procedure.


“Mouthpiece pressure and movement of the teeth during brass playing were measured via strain gauges placed inside and outside the mouths of ten players of the trumpet, horn, tenor bugle, and tuba. Mouthpiece pressure varies by instrument, depends upon the pitch of the note being played, and is not uniformly spread across the four incisors. Tooth movement may reach the physiological limits of dental mobility. It is recommended that removable supports be worn during performance to help stabilize teeth.”

169 Till Jung, Lothar Borchers, and Matthias Gebert, abstract for *RILM* record number 2000-06346.

Dr. Kessler’s study of veteran trumpet player, Alois Hruby, who served thirty-eight years in the Cleveland Symphony Orchestra, reveals the typical embouchure and its effects on the body. A roentgenogram of Mr. Hruby illustrates the compression of the top lip against the teeth. The author suggests that Mr. Hruby’s sixty-year trumpet career is responsible for the flattening of his lips. The author also suggests that the lips may have been flattened due to the horizontal horn angle needed in orchestral playing. Photographs of the trumpeter’s extended tongue are given. Dr. Kessler also hypothesizes that Mr. Hruby’s anterior dental arch bone structure could have benefited from his lifetime of trumpet playing.


Soft tissue trauma, focal dystonia, and overuse injuries affect brass players because of the pressures exerted onto the lips by the mouthpiece. Localized nerve injury is a resulting complication of soft tissue trauma. Symptoms of brass players with dystonias are unclear articulations, impairment of lip control and tone quality. Brass players suffering from overuse injuries and soft tissue damage experience lip swelling, pain, and localized discoloration consistent with subcutaneous hemorrhage.

For proper diagnosis, it is necessary to observe the brass player playing the instrument. While there is no cure for dystonia, treatment includes rest and lip rehabilitation when the player resumes practice. Treatment for overuse injuries and soft tissue damage includes rest, a gradual return to playing, and some modifications of technique in cases where exceedingly unnecessary pressure is used when playing.


At some point, most wind instrumentalists will experience a medical problem with their embouchure. In the performance of brass instruments, the mouthpiece hides the problem from view, making diagnosis difficult. Anatomical and mechanical understanding of the embouchure sheds light on these problems. To this end, high resolution ecographs are able to illustrate muscle activity and their superficial structures. It is non-invasive and allows observation of moving the structures. This research revealed that the maximal force of the orbicularis oris in single reed players is 450gr., compared to 550gr. in double reed performance and 800gr. in trumpet playing. The innovation of the ecograph is that is eliminates the problem of visualization of the problems of the embouchure.

This article discusses the special dental repair concerns for the trumpet player. Due to the date and French publication and text, this article, Pubmed record number 387179, is unavailable for annotation.


Excessive pressure and practice can cause a malfunction in facial nerves and fail to send the proper signals to nerves, resulting in an inability to control the embouchure in brass playing. The musical symptom often heard is “cracking” articulations, though there may be no visible evidence. “Bell’s Palsy” is one type of facial paralysis whose cause is unknown. It is fairly common and, to a great extent, curable with hormone treatment, ultrasound and massage. The least severe stage of interrupting nerve conductivity is called neuropraxia, which can be triggered by circulation disorders and compression of the nerve, both of which can occur in brass playing. On the contrary, pressure on a neurofibril may bring on paralysis, a sudden setback not remedied by rest. Rest, moderation and less mouthpiece pressure are prescribed and most patients resume playing within several months.


Perfect teeth do not equate perfect sound in brass playing, though irregular teeth can cause problems in slurring, trilling, accuracy, range, tonguing or endurance. There are several options in lieu of orthodontia: metal adapters which slide over the problem tooth and provide an even front surface of the teeth. Bonding is another way to reshape the teeth without damage to the teeth. Bonding involves the adhesion of plastic material directly to the tooth where it is recontoured.


Tooth enamel is the hardest substance in the human body, but over-brushing can wear it away over time. This usually occurs when the person is between thirty-five and forty years of age. Brushing too rigorously with an up and down stroke can cause the gums to recede and expose the roots of the teeth. Rough brushing may also cause air leaks that can lead to puffing in the cheeks, especially in low brass players. The best advice is to keep dental hygiene a careful, conscious act, rather than a mindless routine.


Brass players with irregular side teeth may experience problems with articulations, supporting embouchure muscles in the cheek, and problems with air leaks. These include: “muddy” attacks, delayed attacks, a feeling of unevenness along the cheek, air pockets along the cheek and an air leak in through the side teeth in cases where the side teeth tilt inward or outward. Treatment options include tooth extraction, filing irregular teeth flat and removable adapters to fill the gaps.

Over time, mouthpiece and tongue pressure may cause teeth to change angles. These changes are gradual but may affect range and endurance. One tell-tale sign is a change of playing angle. Traditional orthodontic treatment may not be used in these cases as it may damage or weaken the alveolar (bone) structure. Instead, a removable retainer worn at least two hours a day is best.


There are several types of halitosis, but the temporary and most common type is called, physiologic halitosis. Bacteria in the mouth cause foul breath when saliva secretion is low, as during sleep. Playing wind instruments naturally retards physiologic halitosis as playing itself stimulates salivary production. Common causes include: garlic, alcohol, tobacco and stomach medicine. Treatment includes rinsing the mouth with water, brushing, flossing and gargling.

The second type is referred to as morbid halitosis. It is an oral disease in which bacteria thrive and periodontitis occurs. Other factors may cause this condition: chronic bronchitis, digestive organs, diabetes and hepatitis. The treatment for morbid halitosis involves determining first the cause of the disease. In addition to determining and treating the underlining disease, it is imperative to keep the mouth clean.


To avoid long-term and future dental and performance problems on brass instrument, wind instrument teachers should check that students have all twenty-eight teeth, excluding wisdom teeth. In addition, teachers should make note of missing or replaced teeth, as well as any swelling or bleeding of the gums. Problems with missing teeth and gum disease will adversely affect the student’s ability and endurance on a brass instrument and these problems must be addressed by a dentist early.

Examination of the dental arch, the bite, is also important as it may reveal mal occlusion. This, in turn, effects the vertical and horizontal position of the instrument. Students with asymmetric horn angles often have misaligned teeth. Shifts in teeth placement form a U-shaped dental arch will adversely affect tonguing and endurance and such deviations should be corrected by a dentist as early as possible.


Periodontosis is a breakdown of the periodontal tissues securing the teeth: alveolar [jaw] bone, ligaments and gingivae [gums]. It is imperative for wind players to take preventive measures to avoid this condition. The causes of Periodontosis fall into three groups: poor oral hygiene, mouthpiece pressure against an irregular dental arch or irregular teeth, and diabetes, obesity, extended medical treatments or osteoporosis.
Symptoms include pain, itching or unpleasant sensations in the gums after playing. Other non-musical symptoms include bleeding of the gums after eating, brushing one’s teeth or pus appearing after massaging the gums. If such signs occur, a dentist can make recommendations for treatment. One preventative measure is brushing the teeth using the Bass method: holding the brush at a 45 degree angle from the teeth.


In dentistry, common sense goals for functional, aesthetic teeth do not always apply to wind instrument players. Dental treatment can have a significant negative impact of the performance of wind instruments. The idiosyncrasies of a player’s teeth give each player a unique sonority-though many players believe their imperfect teeth are hindering their playing. “Fixing” the teeth cosmetically can be devastating for musicians because of the subtle changes to the teeth. Specific dental procedures that can produce these negative effects on instrumentalists are: crowns, bridges, fillings in the front teeth and a change in the teeth spacing. This can be avoided by carefully explaining to the dentist the imperative role of the teeth in the brass playing apparatus.


Orthodontics poses devastating results to seasoned brass players. The false notion that a perfect smile will improve performance on wind instruments is misguided. Each player’s embouchure has adjusted to the irregularities of the dental structure. Any minute changes place the player’s musical performance in jeopardy. Cosmetic reasons to undergo orthodontia must be weighed heavily against a brass player’s desired level of performance after the treatment.


The eruption of wisdom teeth poses problems for brass playing, primarily in overcrowding. Care should be taken to check the state of wisdom teeth before problems arise. Wisdom teeth should be extracted if swallowing is painful, there is discharge coming from the gums, the gums are swollen, or a sudden high fever appears. The majority of wind instrument players resume playing with no complications.


Oral hygiene is the most effective way to preserve the wind playing apparatus. For wind players, whose careers depend on their teeth, this is even more critical. Such musicians should brush their teeth after eating, in addition to the normal morning and bedtime cleaning. Even so, brushing with too much pressure can do more harm than good. Interdental brushes and floss are effective at clearing food debris between the teeth, though special care must be taken to avoid damaging the periodontal tissues. One trumpet player overzealously brushed his teeth with an interdental brush in the gap between his front teeth. This widened the gap by pushing back the
gums and created a secondary air path that crippled his trumpet playing. Fortunately, a resin “plug” filled the gap and the trumpeter returned to a professional level of playing.


“Pharyngoceles are dilations of the lateral pharyngeal walls. They are either traumatic or congenital and are frequently confused with other pharyngeal and laryngeal dilations like Zenker’s diverticulum and laryngoceles. Distinctions between these are addressed. A case of bilateral pharyngocele affecting a trumpet player is discussed.”

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“The embouchure of the brass player is critical to tone production and largely depends on the integrity of the orbicularis oris muscle. Injury to this muscle can cripple the professional musician by causing fatigue, pain, and tonal deterioration. Ten brass players presented with muscular defects in the orbicularis oris muscle. Examination identified areas of abnormality within the muscle and electromyography (EMG) ruled out a neurologic deficit. All patients underwent exploration under neuroleptic anesthesia, and 9 patients underwent repair. The technique is described. The repaired patients reported improvement after the operation and all resumed playing at their premorbid level. The 10th patient was found to have thinning of the entire orbicularis oris muscle (presumably congenital) and was not able to be repaired. There were no complications of the procedure and no recurrences.”

174


“Suggests strategies for avoiding injury to the horn embouchure, including being attentive to signs of stress, getting enough rest, and drinking plenty of water.”

175 “Offers some suggestions to horn players on preserving and maintaining a healthy embouchure. Cites the author's experience in preventing injury, stressing that "listening to the body" is among the most important lessons. Recommends getting proper rest, drinking plenty of water, and paying attention to diet. Also discusses using massage techniques and suggests that individuals experiment to develop their own specific routine for embouchure health.”

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175 Andrew J. Pelletier, abstract for RILM record number 1999-01108.
176 Andrew J. Pelletier, abstract for IIMP record number 00129518.
Playing music is a cooperation of musician and instrument. Problems occur because of the musician, the instrument, or improper configuration of the two. The breath of the musician does not have a direct influence on the instrument. The sound is a result of vibrations along the air column within the instrument. These vibrations are dependent upon the lips and the buccal cavity. One problem the brass musician faces is that the spaces of the harmonic series become increasingly closer together as the pitch raises. This makes notes easy to crack and is complicated by the fact that the notes have characteristic intonation anomalies that require adjustment from the player. The result is an imbalance between musician and instrument that often causes detrimental flaws in technique. These flaws in technique contribute to typical musician injuries.

Musicians need to sort out their problems to determine if they are: physiological, psychological, mechanical, or musical. For successful treatment, musicians must be willing to follow the therapist’s plan, and be able to describe with detail all symptoms.


“In this paper a second case of rupture of the orbicularis oris in a trumpet player is presented. Treatment by direct suture of the muscle has been successful.”


“The two cases of ruptured orbicularis oris in trumpet players have two common characteristics: First, symptoms appeared after the muscle was stressed by overactivity. And second, rupture took place in the midline, in the lower lip in the first patient and in the upper lip in the second patient. One of the patients thought that pressure of the mouthpiece through the lips and against the teeth contributed to the injury. Both patients recovered very rapidly and experienced no loss of playing proficiency or tone quality.

In the first patient, the muscle was sutured with nonabsorbable material (Supremid), and two stitched extruded after some weeks. In the second patient, following Dr. Kaye’s suggestion, I used long-term absorbable sutures (Vicryl) with no complications up to present.”


A patient entered into the care of Dr. Jaime Planas (Barcelona, Spain) with complaints of pain in the lower lip accompanied by an acute drop in range and endurance, as well as a general tremble observed in his trumpet playing. Exploratory surgery revealed a rupture of the orbicularis oris, the major circular muscle of the lips. The muscle fibers in the posterior were stretched but intact. The fibrous band which joined the ends of the ruptured muscle was carefully removed and the ends reconnected and secured with non-absorbable sutures. After nine months, the scar was red, swollen and painful. A small incision was made and turbid liquid was

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177 Jaime Planas, abstract for Pubmed record number 3375365.
discharged. The sutures were removed. The patient successfully returned to playing in the orchestra.

Other symptoms of a rupture in the orbicularis oris include bleeding crevices and fissures in the lips, as in the case of Louis Armstrong (Satchmo), who stopped playing the trumpet entirely for one year in 1935.

Trumpet players experiencing a rupture in the orbicularis oris are advised to: stop playing for many months, try using a smaller, shallower mouthpiece and/or a wider rim, restrict playing to the lower register- all of which are typically unacceptable to trumpet players.


“Problems affecting the elasticity of the lips of brass players are addressed.”


“A study was undertaken to determine the extent to which velopharyngeal insufficiency (VPI) is a problem for woodwind and brass musicians. Intraoral pressure measurements were performed to determine pressure peaks, mean pressure, and maximum attainable pressures. Of the pool of 148 symphony orchestra professionals and student musicians, 81 were aware of VPI and 24 showed symptoms; six reported that VPI occurred in association with colds, stress, or the playing of extremely high notes. One musician noted that VPI occurred only on return from vacation. Of the symptom-free musicians, 15% reported that they noticed symptoms of VPI during their training, but that these gradually dissipated. Despite reports in the medical literature that predominantly young musicians are affected, only 47% of symptomatic participants in this study were music students (41% of the subjects). Oboists and clarinetists were the most frequently affected, perhaps because they develop relatively high mean pressures. Music instructors are advised to perform pressure measurements during instruction.”


“A twelve-year-old boy had played the French horn successfully for more than 16 months. With no warning or precipitation event, he began to lose oral air pressure after about one-half hour of playing. A year later, an assessment was made of the velopharyngeal (soft palate) dysfunction. Videotape, fluorography, electromyography, oral manometry, and neurologic and speech evaluation techniques were employed. A pharyngeal flap procedure was performed a year and a half later. No symptom related to voice quality or playing the French horn has reemerged in the past six years.”

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179 Jaume Rossett I Llobet, abstract for *RILM* record number 2005-07284.
180 B. Schwab and A. Schultze-Florey, abstract for *RILM* record number 2004-00420.

Because of the pressures necessary for playing a brass instrument, brass players are susceptible to unique medical problems. In addition to hearing loss, uveal engorgement, visual field loss, and pneumoparotid (swelling of the parotid gland), the Hypopharyngeal pressure can cause Laryngoceles, (blowouts of the larynx).

Enharmonic frequencies require differing amounts of pressure when played on different brass instruments, thus leaving Arnold Jacob’s theory that they require the same pressure unsubstantiated. Of all the brass instruments, the horn requires the highest pressure at every frequency. The trumpet has comparable pressure requirements for frequencies greater than 1,024 Hz. Both trumpet and horn demand 110 cm H$_2$O for frequencies over 512 Hz for horn and 1,024 for trumpet.

The aforementioned frequencies and pressure requirements may be too much for young players. Further research is needed to determine safe pressure limits for the young, developing larynx and pharynx. Correct posture and a relaxed larynx are keys to avoiding Laryngoceles.


Dr. Gereige of Montluçon, France prescribes a homeopathic treatment of coarse unrefined sea salt for brushing teeth. This treatment is effective at treating periodontal disease for the author.


Commenting on Dr. Jaime Planas’ article, “Further Experience with Rupture of the Orbicularis Oris in Trumpet Players,” (*Plastic and Reconstructive Surgery: Journal of the American Society of Plastic Surgeons* 81, no. 6 (June 1988): 975-81), Dr. Sullivan suggests that Dr. Planas make a mucosal side incision in the repair of a ruptured orbicularis oris in the future to avoid scaring. Planas agreed, and in fact did so on the same patient in a second operation to shorten the orbicularis oris after the initial rupture and subsequent first repair surgery.


No English abstract is available. More information can be found at Pubmed record number 269784.


“Temporomandibular dysfunction (TMD) appears to be a significant problem affecting musicians. While the incidence of TMD symptoms for musicians is similar to that of the general
population, these symptoms are activated and accentuated when performing or practicing. TMD appears to be significant in trumpet, trombone, tuba, violin, and viola musicians.\footnote{M. D. Horowitz, “Trumpet Citations in Recent Medical and Scientific Literature,” \textit{ITG Journal} 22, no. 2 (December 1997): 49.}


“A description is given of the causes, treatment, and prevention of temporomandibular joint (TMJ) disorder as it relates to musicians. Because of the repetitive motions made throughout the course of a career, instrumentalists are at high risk for developing TMJ.”\footnote{Abstract for \textit{IIMP} record number 00427273.}


A professional trumpet player underwent endodontia (root canal therapy) on his two front teeth. The patient was advised to have the crowns capped and the roots reinforced to strengthen the affected teeth. Such teeth have a high incidence of fracture. The trumpet player did not opt to have the teeth reinforced for fear of an interruption of his career.

Ten years later, the front teeth broke off at the gum line. The patient had no current dentist and sought an emergency clinic to repair the teeth. The patient failed to inform the dentist that he was a trumpet player and aesthetically pleasing plastic crowns were fashioned. The trumpet player experienced a significant impairment in his trumpet playing and sought Dr. Jack Train for advice and repair.

A study of the trumpet player’s embouchure, photographs of the teeth before the accident and discussion of the original teeth revealed that a severe mal-occlusion (bad bite and mal-posed teeth) existed prior to the fracture. Train used an abrasive diamond to recontour the teeth back to their pre-injured shape. Finally, approximately one quarter of a millimeter was shaved off of the length of the caps and the trumpeter nearly recaptured his sound. Careful observation of his trumpet playing revealed that the thickness of the caps was the cause of unclear tonguing. This was corrected and the trumpet player fully recovered his playing abilities.

It is advised that trumpet players seek out a dentist who completely understands the musician’s demands on the dental structure and always inform the dentist if you are a performing trumpet player. Furthermore, the following advice should be followed concerning dental work on trumpet players: always bring your mouthpiece into the dentist’s office when having work done on the front teeth; have a cast made of your teeth for reference in the case of future injury; always make a completely informed decision when treatment is recommended.


A symphony horn player sought orthodontia to straighten his teeth for cosmetic purposes. A removable appliance was used to allow the hornist to continue practicing and performing with the appliance removed. Changes in the horn player’s embouchure were experienced as anticipated. These changes jeopardized the musician’s career in the orchestra and the player was moved to second part from first chair horn. A study of the early x-rays revealed that the horn player’s embouchure was slightly off center due to a forward position of the right central incisor. A porcelain veneer was added to the surface of the right central incisor to return the surface of the
bite to that of the pre-orthodontia treatment. Further orthodontia was terminated and the musician successfully returned to his previous chair in the orchestra.


A forty-seven year old trumpet player exhibited the following symptoms: severe facial pain, ringing in the ears, pain in the back (and sometimes down his legs), loss of balance, and one side of his face pulled up and off to the side secondary to trumpet playing. The symptoms diminished when he stopped playing the trumpet. He also had severe mal-occlusions. An audible click or pop was heard upon opening his jaw. A clinical examination also revealed extreme sensitivity to gentle palpation of the temporomandibular joint muscles. The patient shared that he received a hit to the jaw in high school while playing football on several occasions. Braces were recommended at that time but were not employed due to financial reasons.

After reviewing the literature and consulting other specialists, we concluded that the patient was suffering from acute Temporomandibular Joint Dysfunction, known as TMJ syndrome. The symptoms suggested that one of the tendons was torn or stretch, causing the muscles to pull the jaw back into place. These muscles would soon tire and spasm from performing the ligament’s job. An occlusal splint (a plastic guard worn over the teeth) and muscle relaxants produced nearly immediate relief. In addition, the patient changed mouthpieces from a large Schilke 20 to a Bach 3C. Arthroscopic exploratory surgery is scheduled to investigate proper orthodontic treatment.


The misuse of dentistry on brass players can end the musician’s career if performed by a dentist without training or knowledge of the musician’s embouchure. The use of a bridge in one trumpet player was intended to improve the embouchure that was suffering from a crooked tooth. Instead, the cantilever bridge weakened the supporting teeth, caused periodontal disease and the removal of 50% of the player’s top teeth. The musician is now unable to play. The removal of the healthy tooth for cosmetic and embouchure reasons was a mistake. A simple brace with elastic should have corrected this problem without impacting the embouchure.


Dr. Ward corrects the authors of the 2000 article by the same title, stating that the Drs. Isaacson and Sataloff misdiagnosed bilateral pharyngoceles (air-filled neck masses) for laryngoceles (those found within the laryngeal ventricle). He gives the distinction that laryngoceles generally do require surgery, and pharyngoceles diminish in size if the increased pharyngeal pressure diminishes.

Drs. Isaacson and Sataloff stand by their diagnosis in the reply to the editor, claiming their article did not include images of the intralaryngeal component, which reveals the reason for the lesions’ diagnosis as bilateral laryngoceles. Furthermore, distinctions are not always clear and lesions may combine features of laryngoceles and pharyngoceles.

“Patients who play musical instruments (especially wind and stringed instruments) and vocalists are prone to particular types of orofacial problems. Some problems are caused by playing and some are the result of dental treatment. This paper proposes to give an insight into these problems and practical guidance to general practice dentists. Information in this paper is gathered from studies published in dental, music and occupational health journals, and from discussions with career musicians and music teachers.

Orthodontic problems, soft tissue trauma, focal dystonia, denture retention, herpes labialis, dry mouth and temporomandibular joint (TMJ) disorders were identified as orofacial problems of career musicians. Options available for prevention and palliative treatment as well as instrument selection are suggested to overcome these problems.

Career musicians express reluctance to attend dentists who are not sensitive to their specific needs. General practitioner dentists who understand the instrument’s impact on the orofacial structures and are aware of potential problems faced by musicians are able to offer preventive advice and supportive treatment to these patients, especially those in the early stages of their career.”


“Dentists should be aware of dental problems that are unique to musicians. The playing of woodwind, brass, and string instruments over time may cause lesions and misalignments of the head and neck. Musicians who play brass instruments such as the trumpet, French horn, trombone, and tuba may experience crepitus (cracking sound) of the TMJ, oral ulcers, herpes labialis, and tooth movement. Those who play woodwind instruments such as the clarinet, oboe, and saxophone may develop overbites due to the pressure of the wedge shaped mouthpiece. Violin and viola players may experience TMJ dysfunction because of the pressure they exert in using their chin and jaw to hold the instrument against their shoulder. “Fiddler’s Neck” is a skin lesion found on the area of the chin that comes in contact with the string instrument. Dentists should obtain a full history from musician patients about the amount of time they spend playing musical instruments in order to correctly diagnose and treat these unique dental problems. Fourteen references.”

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185 Marc David Horowitz, “Horn Citations in Recent Medical and Scientific Literature,” *The Horn Call* 28, no. 3 (May 1998): 60.
OVERUSE SYNDROME AND MUSCULOSKELETAL INJURIES

The trumpet, like all other musical instruments, demands hours of practice to achieve a professional level of performance. When this practice and performance exceeds one’s physical limitations, however, overuse syndrome can occur. In musicians, this can manifest itself in the muscles of the embouchure or in the upper extremities. Fortunately, overuse syndrome can be prevented through healthy practice habits with ample rest, common sense, and ergonomics.

The greatest contributor of published information regarding the prevention and treatment of embouchure overuse syndrome is Lucinda Lewis. Her first book, *Broken Embouchures*, describes the symptoms and causes of embouchure overuse syndrome, followed by advice on rehabilitation. *Embouchure Rehabilitation*, Lewis’ second book, presents a comprehensive method for overcoming this occupational illness. Throughout all of Lewis’ publications, prevention is stressed and the means of prevention involve practicing within one’s physical limitations. Shockingly, Lewis asserts that no amount of rest will cure this condition- retraining is required.\(^{186}\) Fry disagrees and prescribes a twelve-month rest period for severe cases.\(^{187}\)

In addition to providing helpful treatments for embouchure overstrain injury, former principal horn player of the Berlin Philharmonic, Bengt Belfrage further contributes to this topic by delineating this syndrome’s etiology in the 2\(^{nd}\) edition of his book, *Overstrain Injuries in Brass Players: Causes and Cure: A Brass-Player’s*

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Testament. Likewise, the research by Culf and Diethelm explicates the appearance of overuse syndrome in the upper extremities and provides warm-up and stretching exercises for prevention. Conversely, Winspur elucidates the problems caused by lack of uniformity in the terminology related to the general category of overuse syndrome, and the subsequent flaws in medical science that result. The article by Dawson is similarly helpful due to its clarification of the terms “tendonitis” and “tenosynovitis.”

This section of the bibliography also examines musculoskeletal disorders that affect trumpet players. Selected articles dealing with nerve compression syndrome (e.g., Amadio) are listed here because overuse syndrome can contribute to nerve compression. Surprisingly, Amadio states that approximately 30% of musicians with a diagnosed musculoskeletal disorder are diagnosed with a nerve compression syndrome.\textsuperscript{188} Hoppman and Reid published a salient article that examines the broad category of medical problems of the upper extremities, including the following: overuse syndrome, entrapment neuropathies, focal dystonia, osteoarthritis, and the complications related to joint hypermobility.


“Nerve compression syndromes are common in the general population, and they are also common in musicians. As many as 30% of musicians who have a recognized musculoskeletal disorder are diagnosed with a nerve compression syndrome. Thus, it is important to consider the diagnosis of nerve compression syndromes in all musicians who present with musculoskeletal complaints. Proper management of these problems is essential if one is to avoid significant morbidity.”\textsuperscript{189}

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{188} P. C. Amadio, abstract for \textit{Pubmed} record number 12852670.
\item \textsuperscript{189} Ibid.
\end{itemize}
\end{footnotesize}


“Bengt Belfrage is a former first horn of the Berlin Philharmonic and teacher at the Royal Academy of Music in Stockholm. …The subject of this 32-page book is evident from the title; the causes of overstrain injuries are both individual and general, and Belfrage begins with some parallels between injuries in sports and music. One key to success is building up strength in the

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190 André-François Arcier, abstract for RILM record number 1999-12612
embouchure, and we are presented with descriptions of why this is important and how one can go about avoiding problems in this area. Therein lies his premise—overstrain injuries can, in fact, be avoided if one is intelligent in practice and aware of proper priorities while playing.

He lists five causes of overstrain injuries: insufficient warming up; inadequate physical conditioning for demanding practice and concert work; poor breathing technique; practicing while in poor health; excessive variations in load, including the roles of rest and recuperation in relation to changes in workload. Each of these causes receives attention regarding how and why these create overstrain, and what can be done to avoid it. Following these, there are sections on psychological tensions, stress and nerves, practicing the performance, learning technique in ways that create positive habits, concentration and mental preparation, embouchure, and air stream.

…The overall goal is a worthy one— to get maximum results from minimum effort. This requires a strong, supple embouchure, relaxed, efficient breathing, and intelligent practice routines that build strength and are adaptable to each player’s current physical capacity. Add to this a personal self-awareness and the patience to practice slowly and correctly every time, and there is no doubt of success.”


Wrongful practice techniques are most often the cause of overuse injuries in brass players. These injuries are becoming more and more frequent. Brass players should look to athletes for healthy warm-up and conditioning practices. A proper warm up warms up the muscles of the lips and improves neuromuscular function and makes the muscles more limber. Furthermore, warming use reduces the risk of injury and improves the musical product. A typical warm-up should include three phases: relaxed playing in any part of the register, flexibility exercises, and awakening the muscle fibers through octave glissandos.

The physical condition of the embouchure must be in such a state that 60-70% of effort and endurance is the maximum needed for any performance situation. This reserve remaining is called the physical margin. Going beyond this margin leads to a drop in dynamics, poor tone quality, poor intonation and a risk of long-term injury.


"An alarming number of musicians are suffering with playing-related aches and pains or more serious 'overuse injuries'. This practical self-help guide explains clearly and simply the causes of such injuries.

Packed with easy-to-follow and constructive advice to help prevent injury occurring, it includes warm-up exercises, stretches and a thorough analysis of all aspects of technique.

The musician is encouraged to take responsibility for his or her own well-being through an understanding of anatomy and physiology, the workings of the muscles, posture, balance and the effects of muscular tension and stress. Sympathetic advice is offered, too, for those already suffering the pain and distress of injury.

Fully illustrated, this book will also interest therapists, doctors, counselors and other health care professionals."

Lucinda Lewis describes overuse injury as often occurring when instrumentalists have played more hours than usual or with more intensity than usual. The typical symptoms are facial fatigue and noticeable lip swelling. Lewis recommends suspending practice on the instrument for a few days. If the problem has developed into full-blown embouchure overuse syndrome, mechanical rehabilitation is the only method that will return the player to their previous abilities. Rehabilitation can be seen in two to four weeks, though complete recovery and retraining takes longer. Surgery is not recommended; retraining one’s technique is. Emotionally, this disorder is crippling. Players should be comforted in knowing that if they can persevere through the rehabilitation and retraining, the problem is curable.


Tendonitis is an overused “diagnosis” that has become a catchall diagnosis for any problem affecting the hand, wrist or arm. It is, in fact, inflammation of a tendon or its coverings. When the tendonitis is accompanied by inflammation of the surrounding tissues where the tendon glides through tight spaces, this is referred to as tenosynovitis. The principle cause is overuse, specifically excessive repetitive motions. Symptoms are characterized by localized pain. Treatment includes rest and sometimes the use of a splint. Injections of steroids are effective as well.


If pain is caused by playing a musical instrument, the cause may be overuse syndrome. Overuse occurs when normal actions put the body under more stress than biological tolerance allows. The degree to which this affects individuals is dependant upon several factors, including: age, gender, constitution, condition, musical training and experience, as well as events and musical experiences in the musician’s life.

Musicians should avoid jumping to conclusions when pain is felt. A common mis-self-diagnosis is “tendonitis.” This term is used broadly when musicians describe their own pain; however, a physician should be able to more accurately diagnose the ailment. For instance, painful inflammation of the tendon sheath is called “tenosynovitis,” while painful inflammation of the tendon itself is specifically called “tendonitis.” Such pain is not always a result of mechanical strain and may be early signs of general musculoskeletal disorders, such as arthritis.

Between 1981 and 1994, the Chicago hand surgeon, Dawson, treated 1,354 instrumentalists, only 147 of whom developed their overuse syndrome while playing their musical instrument. The key here is to carefully observe what one does in a normal day apart from playing music.

Genuine overuse syndrome generally occurs when musicians play more often than usual. The body gives important warning signals, such as a feeling of heaviness when simply holding the instrument and pain between the shoulder blades while playing or holding the musical instrument. Overuse syndrome cannot be effectively treated with massage or with an operation.

When experiencing chronic recurring pain, it is imperative to avoid altering the physical posture and mechanics of playing a musical instrument to avoid the pain. Instead, it is best to listen to one’s body and perhaps examine one’s technique, repertoire or instrument. Under constant pain, the nervous system can develop pain memory which may outlast the ailment which triggered it.


When overuse syndrome occurs, first investigate the potential causes carefully before rushing into treatment. Avoid a narrow and a wide view of causes during this investigation. Looking only toward the local area of pain is a narrow view. Searching for answers too widely is also unhelpful, such as blaming pain on food intolerance or poisoning.

It is also advisable to design a treatment plan based on a thorough diagnosis. This plan should coordinate different therapies, and set timetables to achieve objectives. This includes following advice for rest beyond the symptoms’ remission. Other pain is caused by the use of excessive force. The Alexander Technique, Feldenkrais Method, kinesiology, or yoga may offer insight into the body’s natural signals and give musicians helpful self-awareness.

The goal should be to play musical instruments without pain, taking adequate breaks when needed. These rests are opportunities to stretch, loosen and relax muscles.


“Hand surgery in musicians and hand surgery of the rheumatoid hand are main subjects, beside others, of the Hand Surgical Department of the DRK-Clinic in Baden-Baden/Germany, clinically as scientifically, too. There are some special aspects of surgery of the hand in musicians with rheumatoid arthritis. Between 1980 and 2001, seven musicians with this inflammatory disease (3.8% of all 185 musicians, gathered up to April 2001 in our musician's data bank) did seek help. Among these patients, we performed surgery in five musicians (four professionals, one semi-professional), but altogether 18 operations have been performed in these five musicians. Three of these five musicians were able to continue their original musical activity for many years despite their rheumatoid arthritis, one of them switched from soloist to teaching activity, one we lost to follow up. In musicians, individual considerations about the indication, the type of surgery and its details must be made pre-operatively. These may depend upon the instrument played and which hand or finger is affected. If possible, the expected results of surgery should be assessed during a preoperative recitation, using static or dynamic test-splints or plasters and having the musician play with these external devices.”

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193 N. Ell, abstract for *Pubmed* record number 15744656.

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“Musicians are exposed to high-risk musculoskeletal activities such as repetition, hours of exposure, and awkward postures when playing instruments. These activities may result in playing-related musculoskeletal disorders. Musicians often work part-time or seasonally or are self-employed. Thus, they may be uninsured or underinsured and may delay seeking care for these painful and potentially disabling conditions. Prevention of playing-related musculoskeletal disorders includes identification of both intrinsic (e.g., musician strength and flexibility) and extrinsic (e.g., musician posture while playing an instrument) factors involved in the interface between musicians and their instruments and the playing environment (e.g., rest breaks or hours of practice). Student occupational health nurse practitioners in this pilot project performed outreach and comprehensive screening and treatment for a small group of musicians diagnosed as having playing-related musculoskeletal disorders. Tendon and nerve gliding exercises were a key component of the treatment plan.”


“Overuse syndrome in musicians was extensively reported 100 years ago. The clinical features and results of treatment, which were recorded in considerable detail, match well the condition that is described today. The medical literature that is reviewed here extends from 1830 to 1911 and includes 21 books and 54 articles from the English language literature, apart from two exceptions; however, the writers of the day themselves reviewed French, German and Italian literature on the subject. The disorder was said to result from the overuse of the affected parts. Two theories of aetiology, not necessarily mutually exclusive, were argued. The central theory regarded the lesion as being in the central nervous system; the peripheral theory implied a primary muscle disorder. No serious case was put forward for a psychogenic origin, though emotional factors were believed to aggravate the condition. Advances in musical instrument manufacture--particularly the development of the concert piano and the clarinet--may have played a part in the prevalence of overuse syndrome in musicians. Total rest from the mechanical use of the hand was the only effective treatment recorded.”


“Overuse syndrome, a condition of pain and loss of function in muscle groups and ligaments through excessive use, is common in musicians. In this series, the less serious cases of the disorder have been successfully treated by a modification of physical activity while allowing the musician to continue to play. The more serious cases were treated by a radical rest programme, first described last century, usually up to 12 months, until the patient is pain free and the muscles and ligaments are no longer tender. Performance is then very gradually resumed.

194 I. Foxman, and B. J. Burgel, abstract for *Pubmed* record number 16862878.
195 H. J. Fry, abstract for *Pubmed* record number 3540544.
The criterion for total success is a return to music performance free of pain with sustainable practice habits.¹⁹⁶


“Within the new field of performing arts medicine is an active group of researchers and clinicians who are dedicated to advancing our understanding of musculoskeletal problems of performers. Among these problems are those of the upper extremity in instrumental musicians such as overuse syndrome, entrapment neuropathies, focal dystonia, osteoarthritis, and problems related to joint hypermobility. The epidemiology of these problems is presented as well as results of recent studies investigating their etiology as they relate to musicians. A brief discussion of the treatment of injured musicians also is included.”¹⁹⁷


Contrary to Drs. Liu and Haydn in their article, “Maladies in Musicians” published in the Southern Journal of Medicine in 2002, rest is not the only reliable treatment for overuse syndrome. Around the year 1998, a revolutionary new treatment called Prolotherapy, or proliferant therapy, was discovered to stimulate affected areas of over-use syndrome to heal.

The body heals itself by responding to chemical signals emitting from damaged tissue cells. The body responds to these signals by sending macrophages to clear the debris, followed by fibrocytes, which stimulate the growth of new collagen, the basic material of tendons, ligaments, fascia and joint capsules. In the case of overuse syndrome, there are no “damaged” tissues and the body does not receive the chemical signals needed to heal.

Prolotherapy works by intentionally causing minor damage to the affected tissues via an injection of dextrose (sugar water), which causes the tissues to elicit the chemical messages instigating macrophages and fibrocytes. While cortisone injections are effective in treating the pain, only proliferant therapy heals the actual tissue.


“Occupational injuries common to professional musicians are categorized by instrument type (strings, brass, winds, piano, and percussion) and suggestions for correct posture and practice methods are provided. Other medical problems that may affect professional musicians, such as weakness of connective tissue, poor ergonomics, scoliosis, and irregular working hours, are also discussed. A brief overview of diagnostic methods and therapies is included.”¹⁹⁸


¹⁹⁶ H. J. Fry, abstract for *Pubmed* record number 3184089.
¹⁹⁷ R. A. Hoppmann, and R. R. Reid, abstract for *Pubmed* record number 7766496.
¹⁹⁸ Albrecht Lahme, abstract for *RILM* record number 2004-00614.
Embouchure overuse syndrome can affect players of all ages and abilities. Embouchure rehabilitation begins with creating a healthy habit of balanced energy and tension in the muscles needed for playing. Rehabilitation training re-establishes utility and reliability of the basic playing mechanism. When encountering overuse syndrome, it is tempting to move the embouchure; however, the best cure is to retrain the embouchure with proper structural tension. Buzz pipes, blowing and mouthpiece exercises are effective at this task. It is crucial to have a realistic mindset of your progress during rehabilitation and avoid fear and frustration. No amount of time off the instrument or practice can make overuse syndrome go away. Retraining is necessary.


Embouchure overuse syndrome is the most common cause of embouchure dysfunction and pain. It is caused from playing longer and with greater intensity than usual, though medical, dental and emotional trauma may be a contributing factor. Facial fatigue and swelling are symptomatic of embouchure overuse syndrome. Embouchure problems do not affect the general population and therefore are more difficult to treat. Many symptoms can not be viewed, seen or felt by a physician; they must be heard and felt by the player. It is best to practice within safe limits of one’s abilities to avoid this chronic illness.


Guidelines are presented for brass players on embouchure issues that can develop with improper technique or overuse. Tips on how to avoid overuse injury, what warning signs to look out for, and which remedies are best for existing embouchure problems are offered.


“Embouchures are one of the most vital parts of a brass musician’s playing, but many musicians face physical health problems with their lips. Performance related overuse can result in physical trauma and can be detrimental to one's career. The book "Broken Embouchures: An Embouchure Handbook and Repair Guide" discusses this overuse and strategies to avoid injury.”


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199 Lucinda Lewis, abstract for *IIMP* record number 00268976.
“Comprehensive information on the causes and effects on brass playing of Embouchure Overuse Syndrome, including lip injuries, lip swelling, and other things that make playing a challenge.”


Acid reflux disease can contribute to mouth discomfort and hypersalivation. Prescription antacid drugs are usually effective. If hypersalivation persists, a prescription antidepressant or allergy medicine may be taken as both cause dry mouth.

A small percentage of the population has an allergy to nickel, the most common metal in mouthpieces. The easiest solution is to switch to a solid sterling, gold, or plastic mouthpiece. Screw-rim mouthpieces with gold plating are also often effective.

Bell’s palsy is a condition in which one side of the face experiences paralysis. This condition is caused from a viral infection, possibly herpes, which affects the nucleus of the seventh cranial nerve. Recovery can take from a week to a year, and the patient may never regain 100% muscular function.

Performance anxiety can produce real physical symptoms in brass players. Prescription Beta blockers are an effective way to block the negative affects of adrenaline on the body. This kind of drug must be taken with careful supervision from a doctor as it has numerous side-effects.

Other brass ailments are more enigmatic, such as Burning Mouth and Burning Lip Syndrome. Both of these conditions are more common in women than in men. The symptoms are as the names of the disorders suggest. Nutritional deficiencies, referred pain, hormonal imbalances, allergies, infection, GERD, sensory neuropathies, and physiological factors may be the cause.

More common mouth disorders are canker sores, chapped lips and cold sores. Canker sores are unrelated to cold sores. They are thought to be stress induced. Cracked lips can be caused from a number of factors, including: sun exposure, cold weather, dry air, allergic reactions and excessive licking of the lips. Cold sores are a manifestation of the herpes simplex virus. This virus never leaves the body after it is infected. A common cold, fever, food, food allergies, sunburn, stress or fatigue can wake the virus from its dormancy.

Fibromyalgia is a painful condition with no cure. It is unclear what causes this disorder. There are two kinds of fibromyalgia: primary (affecting the whole body), and localized. Symptoms include general body aches, depression, disrupted sleep, anxiety, fatigue, irritable bowel syndrome, and sudden sharp pains. Women tend to suffer from primary fibromyalgia more than men, but men suffer from localized fibromyalgia more than women.


“A significant proportion of musicians suffer musculoskeletal problems as a result of playing their instruments. The author describes the British Performing Arts Medicine Trust founded by Dr. Ian James 12 years ago to address these problems in Great Britain. The author, a rheumatologist consultant since its inception, reviews over a thousand cases seen at these clinics. Almost half of these patients had no obvious structural abnormality sustaining symptoms through

poor posture, bad practice techniques, unfitness and overuse. Lack of full rehabilitation after injury was the most common cause of structural disorders. The responsibilities for prevention of injuries are described for the three components of the profession: musicians, teachers, and administrators.201


“Awareness of the tasks required to play a particular instrument requires observation of technique and understanding of the dynamic and static loads placed on the musculoskeletal system to play a particular instrument. Anatomic differences, variation in hand size, gender, instrument choice, and maintenance of the instrument all may play a role in the development of playing-related complaints. Simply observing particular instruments, we can see a variety of positions that are required to play the instrument. Important to the discussion of overuse syndromes, we must evaluate the duration of practice sessions and warm-up and cool down periods, which may help minimize playing-related problems. Avoid absolute rest and opt for relative rest for playing-related problems. Immobilization for more than 3 to 4 weeks may lead to greater risk of injury when playing is resumed. Return to play schedules should start with simple, soft music, doubling minutes of playing every few days, dropping back if pain develops. Practical advice may include building up practice times gradually with 5- to 10-minute intervals in 60- to 90-minutes sessions. This recommendation is supported by the findings of Lutz and colleagues who showed decreased blood flow to the forearm after repetitive hand and wrist activities for 90 minutes. This decrease in blood flow normalized after 5 to 10 minutes of stretching exercises. Players with hypermobility should consider limiting practice sessions to 45 minutes allowing for rest breaks of 10 to 15 minutes. Fry suggested a shift in thinking of ergonomics as a reactive strategy to one in which we anticipate and prevent problems before they become insidious or severe enough to limit the ability of the instrumentalist to play. Joint protection is important in all musicians, and although youth can be forgiving for many, we must remind our patients about joint protection as it applies to activities of daily living. Instrumentalists rely on their hands and finger joints to allow them to perform. Basic principles that apply to patients with all types of arthritis also apply to our patients when activities that worsen symptoms or place unnecessary stress on joints are identified. Using adaptive equipment to open jars is an obvious example. Overall, engaging the patient to observe routine behaviors may lead to the identification of modifiable activities, which might be aggravating or manifesting as a playing-related discomfort. Although some injury patterns can be associated with particular instruments, remember that your guitar-playing patient may be taking drum lessons on the side, which could result in lateral epicondylitis that bothers him when he plays the guitar.”202

“To Your Health: Play Smart with Your Muscles.” International Musician 102, no. 11 (November 2004): 9.

“Several new hypotheses on the causes of muscle cramps, and subsequent cures and preventions for cramping, are discussed. Dehydration was once thought a significant contributing factor, but this theory is disputed.”203

201 C. B. Parry, abstract for Pubmed record number 12852674.
202 S. A. Storm, abstract for Pubmed record number 17097488.
203 Abstract for IIMP record number 00356634.

“The findings of this investigation have suggested a new theory to help explain the origin of activity-related pain. It proposes an as yet unrecognized physiologic process (the physiologic activity limitation process). When the intensity of an activity is greater than that appropriate for an individual's level of fitness for that activity, this process then generates unpleasant sensations, physiologic activity-related pain, the function of which is to limit that activity. The physiologic pain generated by this process will have pathways in common with pain caused by other protective mechanisms.”


“Medical opinion remains divided on the existence of a specific medical entity of nonspecific arm pain produced by repetition. Controversy also exists in the pathophysiology of certain painful, anatomically defined medical conditions in the hand and arm and the role of repetition, cumulative trauma, and microtrauma in the development of these conditions. The flaws in science and the language are examined in this article, as are the results of a survey of Australian music students in comparison with nonmusic students, questioning accepted wisdom on repetitive strain injuries.”

204 J. W. White, et al., abstract for Pubmed record number 12852676.
205 I. Winspur, abstract for Pubmed record number 12852675.
VISION PROBLEMS

Trumpet playing can cause or contribute to various medical problems of the eyes. For some problems, trumpet playing is causative. Wind instrument playing, for example, transiently raises the intraocular pressure in healthy musicians by 9.6%. J. S. Schuman, et al., report that over time, these pressure changes can cause visual field loss, glaucoma damage, and uveal thickening due to long term intermittent IOP (intraocular pressure). Some researchers, such as Aydin, et al., are unsure about the significance of this discovery and call for further research. Another physician discredits the Schuman study and its methods altogether! Regardless, in light of this new research, this condition is now classified as “intermittent high pressure glaucoma,” which previously would have been diagnosed as “normal tension glaucoma.”

Among the studies merely presenting a correlation between trumpet playing and vision problems, Fournier, et al., find that approximately half of the 1410 musicians surveyed report having vision problems- most commonly, myopia (i.e., nearsightedness). Also fascinating is the recent categorization of eyestrain as a type of repetitive stress disorder prevalent in musicians. Some existing vision problems are worsened by environmental factors, such as poor lighting, heightened contrast between

206 P. Aydin, et al., abstract from Pubmed record number 10958606.
208 P. Aydin, et al., abstract from Pubmed record number 10958606.
the bright stage lights reflected off of the music stand and the darkened auditorium (i.e., dazzling), and the quality of the manuscript.


“PURPOSE: To evaluate the effect of wind instrument playing on intraocular pressure. METHODS: In a prospective, nonrandomized clinical trial, 24 eyes of 24 wind instrument players with no history of any ocular or systemic disease were evaluated. The musicians were members of Bilkent Academic Symphony Orchestra of Bilkent University in Ankara. A complete eye examination, including best-corrected visual acuity, slit-lamp examination, and fundus examination, was performed. The intraocular pressure was measured before and after a 90-minute rehearsal of a piece by Wagner. All intraocular pressure measurements were carried out by the same researcher using Goldmann applanation tonometry. The difference in intraocular pressure measurements before and after the 90-minute wind instrument-playing performance was analyzed. RESULTS: The mean intraocular pressure was 13.79 +/- 1.93 mm Hg before and 15.12 +/- 2.44 mm Hg after the performance. Wind instrument playing significantly increased the mean intraocular pressure by 9.6% (P = 0.0149). CONCLUSION: These results indicate that wind instrument playing may significantly increase intraocular pressure in healthy patients. The significance of this finding for patients with suspected normal-tension or high-tension glaucoma needs further evaluation.”


52.7% of orchestral musicians and 57.2% of music professors out of 1410 surveyed report having vision problems. The most common vision impairment reported was Ametropia (84%), a refractive error that prevents the eye from focusing the image of distant objects on the retina. Specifically, 81.76% report having Myopia (near sightedness), a refractive error in which the eyeball is too long or the lens system of the eye is too powerful causing light rays to focus in front of the retina.

The visual problems of musicians are influenced by the score quality of the music, dazzling (the contrast between background lighting and the reflected light off of the page of music), and poor lighting conditions. These factors cause undue eye strain and fatigue which aggravate existing visual impairments.


The findings of J. S. Schuman, et al. correlating trumpet playing and raised intraocular pressure via the Valsalva maneuver are not founded on normal playing conditions for trumpet and

211 P. Aydin, et al., abstract from Pubmed record number 10958606.
are quite possibly false. Because the Schuman study took place with the trumpeter laying on his back with an ultrasound probe touching the right eye and the left with a pneumotonometer and possible retrograde saliva draining from the lead pipe into the oral cavity, the study was compromised. These non-physiologic conditions themselves could have produced the Valsalva maneuver and raise the IOP. Other factors were not considered in the Shuman study, including mouthpiece size, mass, bore diameter or bell flare- all of which can affect the resistance of the horn and alter the findings of IOP.


Dr. Markoff’s concern that the supine nature of trumpet playing used in the study, “Increased Intraocular Pressure and Visual Field Defects in High Resistance Wind Instrument Players,” compromised the results is unfounded as the study indicates measurements taken in both the sitting and supine positions. The ultrasound biomicroscopy used to study the uveal thickness required the use of the supine position. No differences in the measurements were found between the two playing positions, including playing in the high register playing and at loud volumes. Furthermore, studies are found that both support and dissent the use of the Valsalva maneuver in wind instrument playing. Additionally, the physical structure of the instruments and manifestation of wind resistance was beyond the scope of this study.


Joel S. Shuman, MD, Emma C. Massicotte, MD, Shannon Connolly, BA, Ellen Hertzmark, MS, Bhaskar Mukherji, MD, and Mandi Kunen, MD investigate a correlation between intraocular pressure (IOP) and high resistance wind instruments. Both high and low resistance wind musicians experience a transient rise in their IOP while playing. The magnitude of the IOP increase is indeed higher among high resistance wind players. Furthermore, these pressures cause visual field loss, glaucoma damage, and uveal thickening due to life-hours of long term intermittent IOP. The measured change in the visual function among high pressure wind players is small and unlikely to be significant except in a minority of professional musicians.

When a trumpet player plays softly, the IOP rises at .88mmHg/sec. When playing at high pitches and loud dynamics, the IOP rises at 1.8mmHg/Sec. The IOP of the case study at rest is 16mmHg compared to 46mmHg when playing high notes and loudly. In short, the force of blowing and the pitch sounded determine the rate of IOP change.

While there is conjecture among researchers, evidence shows that the IOP elevation results from an increase in uveal volume via the Valsalva maneuver caused by high-resistance wind instrument playing. A Valsalva maneuver (the inflating of the inner ear caused by closing the mouth and nose and blowing) causes a rise in intrathoracic pressure and compression of the intrathoracic venous system. This rise in venous pressure results in an increase in IOP transferred through the jugular, orbital, and vortex veins to the choroids. IOP is also elevated by venous pressure rises in the episcleral veins, but at a slower and somewhat insignificant rate.

High resistance wind players show high incidences of minor glaucomatous damage compared to other musicians. The cumulative effects of long-term high resistance wind instrument playing IOP elevations may be sufficient enough to cause eye damage. Because of
this research, this condition is now classified as intermittent high pressure glaucoma, which previously would have been diagnosed as normal tension glaucoma.

“To Your Health: The Eyes Have It.” *International Musician* 102, no. 8 (August 2004): 11.

“Eye problems are an often-overlooked health issue for professional musicians. Opticians consider eye strain a form of repetitive stress injury, which takes time to develop and a long time to treat. Two other eye problems that commonly affect musicians include astigmatism (abnormal curvature of the lens) and anisometropia (a large difference between the refractive power of the two eyes). Several actions that can be taken to reduce the risk of eye trouble are listed, including wearing correct lenses to play, lubricating one's eyes, adjusting the music stand correctly, and finding an optician who understands the work musicians do.”


The supplement for this journal issue is missing and therefore unavailable for annotation. No published abstract exists.