Incidence of Upper Extremity Discomfort Among Piano Students

Joan M. Revak

Key Words: hand injuries • occupational diseases • pain

The purpose of this study was to determine the incidence of upper extremity discomfort among piano majors at seven Philadelphia-area music schools. A questionnaire was distributed to 232 students, and a 31% return rate was obtained. Thirty (42%) of the 71 respondents reported experiencing discomfort that lasted more than 1 week, and 41 (58%) of the respondents reported experiencing little or no discomfort. Twenty-six (87%) of the students with discomfort suspended practice for a period of time or made adjustments at the piano. Pain/aching was the predominant discomfort reported among students. Students experienced their discomforts most frequently in the hand (49% of respondents), the forearm (19% of respondents), and the wrist (16% of respondents). The majority of students reported an impaired ability to play the piano that lasted for 6 months or less. Further research is needed to verify the scope of the problem among student pianists and to substantiate the numerous causes of discomfort that were uncovered in this study. This occupational group could benefit from the knowledge and skills of occupational therapists in the area of occupational performance and physical function.

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Instrument-related hand and arm injuries have plagued musicians for over a century (Harmon, 1982; Poore, 1887), but the etiology of these injuries has not always been readily apparent. Although poor technique, overpractice, and improper training have often been cited as possible causes of upper extremity injuries in musicians, no scientific evidence has confirmed this relationship (Silverman, 1983; Ziporyn, 1984). The advent of "musical medicine" in the 1980s may not only remedy the lack of information available on the etiology of upper extremity injuries in musicians but also help occupational therapists determine suitable treatments and methods of prevention.

The frequency with which occupation-related injuries occur in the upper extremities of musicians is unknown. A systematic review of the literature dealing with occupational diseases of instrumental musicians (Harmon, 1982) revealed that statistical documentation of the prevalence of these conditions was negligible in both the United States and Canada. Scattered reports of hand injuries have appeared in medical and musical literature over the years, but an increased coordination of efforts between medical professionals and musicians has only begun recently (Lederman & Brandfonbrener, 1986; Silverman, 1983).

I conducted this study to meet the need for a "systematic, objective survey of a representative population" (Harmon, 1982, p. 41). I selected students majoring in piano as the focus of my research effort. This decision was partly based on the interest generated by the media attention given to two world renowned pianists, Leon Fleisher and Gary Graffman, whose occupation-related hand conditions disrupted their performance careers. I felt that the identification of the physical discomforts experienced by pianists at the beginning of their careers and the circumstances surrounding the development of these discomforts was important to an understanding of the scope of the problem among older professional pianists.

Literature Review

Medical literature contains little research material on upper extremity injuries in musicians. At the time of this study, the only published analytical research in American medical journals was a paper by Hochberg, Leffert, Heller, and Merriman (1983), which described their findings based on examinations of musicians or correspondence with musicians who had physical complaints. The population they described comprised a large number of professional musicians whose ages spanned 60 years. The majority of these musicians had had symptoms for at least 5 years, with the onset of symptoms occurring when they were approximately 31 years of age.
Pain was the predominant complaint of these musicians, although numerous other symptoms were mentioned, including a loss of muscle control, weakness, and tightening. The right upper extremity was the site of involvement twice as often as the left upper extremity. Forty-five percent of the difficulties reported involved the right hand, especially the ring and little fingers. Inflammatory conditions of the tendon and synovium were the most common problems reported, nerve entrapment and motor control disorders were also mentioned frequently.

The etiology of inflammatory problems among musicians appears complex and is far from being completely understood. Stanish (1984) divides the etiological causes of overuse injuries into two groups: intrinsic and extrinsic. Intrinsic causes may include defects in genotype, such as malalignment (Stanish, 1984) or hyperlaxity (Beighton, Grahame, & Bird, 1983). Intrinsic causes related to age may include skeletal maturity (Stanish, 1984) and rate of healing (Jobe, 1988). Extrinsic causes (those originating outside the individual) are numerous. In sports-related literature, improper skill technique, improper training, lack of preconditioning, and overexertion are often cited as causes of inflammatory disorders (Cantu, 1982; Ciullo & Zarins, 1983; Stanish, 1984).

Similar extrinsic causes of inflammatory hand injuries have been postulated by physicians treating musicians. Leffert (Silverman, 1983) believed many of the damaging routines musicians practice are performed because someone suggested them, believing them to be beneficial. Poor practice habits combined with improper technique may be particularly harmful to musicians. Polnauer and Marks (1967) stated that a physiologically inefficient player tends to "overexert himself, fatigue more readily and [be] more prone to develop an occupational disease than a player whose technique is based on more sound physiological principles" (p. 25). Horenstein (1986), a neurologist at the Cleveland Clinic, stated that "inappropriate and incomplete mechanical resolution of muscle tension" is often seen in young performers who develop cramping, immobility, and abnormal movement patterns of the fingers (p. 59).

Hand position on the keyboard may also contribute to overuse injuries. Hochberg and Leffert (Silverman, 1983) noted that pianists have a tendency to ulnar deviate the right hand as it travels up the keys. They believe this position is anatomically inefficient the higher up the keyboard the hand travels, particularly for forte playing.

The purpose of this descriptive study is to investigate the incidence of physical discomfort in the upper extremities of piano students and to obtain information on the interactive effect of piano playing and upper extremity injuries.

Method

A total of 232 undergraduate and graduate students majoring in piano performance, piano concentration, or piano pedagogy at seven music schools in the Philadelphia metropolitan area were surveyed.

A two-page questionnaire containing both closed- and open-ended questions was designed to elicit (a) a description of the hand and arm discomforts experienced by piano students, (b) the effect of these discomforts on piano playing, and (c) the possible causes of the discomfort. Discomfort was used in a general sense and was not defined on the questionnaire. Some questions were taken from similar survey instruments on arm and hand problems that were developed by physicians at Massachusetts General Hospital (Silverman, 1983) and by the Cleveland Clinic Foundation's Task Force on Musically Related Injuries. Other questions were derived from my own experience and particular interests. A final version of the questionnaire was developed after being pilot tested by three reviewers with strong backgrounds in piano, one of whom was a piano teacher with an occupation-related injury.

Cover letters and questionnaires were delivered to the 232 students according to arrangements with each school's administration. Only one school permitted direct mailings to its students. The students were given 2 weeks to complete the questionnaires and return them in self-addressed envelopes. Administrators at three schools agreed to allow a second mailing, and follow-up questionnaires were distributed to students at those schools.

Results

Seventy-one students, or 31% of the survey sample, returned their questionnaires. The highest response rate (89%) from an individual school was obtained from the only school that permitted direct mailings to the students. Although two-thirds of the total number of students surveyed were enrolled in one of two universities, only 20% of the questionnaires distributed to those students were returned. The lower return rates from these two schools reflect (a) the difficulty involved in distributing questionnaires to large numbers of students through intermediaries and (b) the fact that no second mailing was possible at either school.

The majority (75%) of respondents were undergraduates. Sixty-eight percent of the respondents were women, and 32% were men.

Thirty (42%) of the respondents indicated they had experienced physical discomfort in their hands or arms that persisted or recurred for more than 1 week and that impaired their ability to practice the piano. The respondents with physical discomfort in their
upper extremities were predominantly women (86%), under 25 years of age (70%), and right-hand dominant (75%). Although female respondents outnumbered male respondents by a ratio of 2:1, women still appeared to have a greater incidence of physical discomfort in their upper extremities than men did.

Description of Discomfort

Eighty-three percent of the respondents with physical discomfort reported more than one symptom. Pain or aching of the upper extremities was the predominant discomfort experienced (see Table 1).

The respondents were divided into two groups, those who sought treatment and those who did not. The discomforts reported by each group differed. Pain/aching (82%) was the only physical discomfort reported by more than half of the students who sought medical treatment. Students in this group also frequently complained of tenderness (47%). Over half of the students not seeking medical treatment reported pain/aching (71%), fatigue (65%), weakness (59%), and muscle cramp (53%).

Fifteen (50%) of the students that experienced physical discomfort reported it in both hands and/or arms. Eight students reported discomfort only on the right side, and six students reported discomfort only on the left. As shown in Table 2, the most frequent regions of discomfort were the hand (49%), the forearm (19%), and the wrist (16%). Discomforts were reported nearly equally on the dorsal and volar surfaces of the wrist and forearm.

Table 3 indicates the occurrence of discomfort in the hand, in the right hand, the long, ring, and little fingers were involved most often. In the left hand, the ring finger was affected most often. The majority (57%) of respondents who reported discomforts in these fingers located their discomfort in the area from the metacarpophalangeal joint to the base of the metacarpal.

Fourteen of the 17 students who sought medical treatment obtained diagnoses of their upper extremity discomfort. Nine students (64%) received diagnoses of tendonitis/tenosynovitis, nerve entrapment/compression, overuse syndrome, and/or tennis elbow/epicondylitis. One student was diagnosed with traumatic arthritis, one with a stretched capsule of the metacarpophalangeal joint, one with water retention, one with irritation and swelling, and one with neck tension.

Effect of Discomfort at the Piano

The ability to play the piano was disrupted for 6 months or less for 20 students (69%). The piano playing of 11 students (38%) was impaired for less than 1 month. Only 3 students continued to have problems that impaired their playing for longer than 1 year.

Table 1
Frequency of Discomforts Experienced by Students

<table>
<thead>
<tr>
<th>Discomfort</th>
<th>Treatment Sought (n = 17)</th>
<th>%</th>
<th>No Treatment Sought (n = 17)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain/aching</td>
<td>14</td>
<td>82</td>
<td>12</td>
<td>71</td>
</tr>
<tr>
<td>Weakness</td>
<td>4</td>
<td>24</td>
<td>10</td>
<td>59</td>
</tr>
<tr>
<td>Tenderness</td>
<td>8</td>
<td>47</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>Fatigue</td>
<td>1</td>
<td>6</td>
<td>11</td>
<td>65</td>
</tr>
<tr>
<td>Stiffness</td>
<td>5</td>
<td>29</td>
<td>7</td>
<td>41</td>
</tr>
<tr>
<td>Muscle cramp</td>
<td>1</td>
<td>6</td>
<td>9</td>
<td>53</td>
</tr>
<tr>
<td>Tingling/numbness/burning</td>
<td>5</td>
<td>29</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Loss of control</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>35</td>
</tr>
<tr>
<td>Redness</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Swelling</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Curling/drooping of fingers</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note. *Four of the 30 students are represented in both columns because they sought treatment for some discomforts and did not seek treatment for others. *This discomfort was written in by a student. All others were listed on the questionnaire.

Table 2
Occurrence of Discomfort in Upper Extremity by Region

<table>
<thead>
<tr>
<th>Region</th>
<th>% of Total Reports</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand</td>
<td>49</td>
<td>27%</td>
<td>22%</td>
</tr>
<tr>
<td>Wrist</td>
<td>16</td>
<td>18%</td>
<td>7%</td>
</tr>
<tr>
<td>Forearm</td>
<td>19</td>
<td>12%</td>
<td>9%</td>
</tr>
<tr>
<td>Elbow</td>
<td>6</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Upper Arm/Shoulder</td>
<td>10</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>59%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Note. *Fourteen students reported 27 areas of discomfort in the hand. *Thirteen students reported 26 areas of discomfort in the hand.

Table 3
Occurrence of Discomfort in the Hand

<table>
<thead>
<tr>
<th>Region</th>
<th>% of Reports in Upper Extremity</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>6</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Long</td>
<td>8</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Ring</td>
<td>12</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Littie</td>
<td>9</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Thumb</td>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Unspecified</td>
<td>7</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>27</td>
<td>26</td>
</tr>
</tbody>
</table>

Note. *These numbers are derived from the division of the number of discomforts reported in each region of both hands by the total number of discomforts reported in the upper extremities. Some respondents reported more than one area of discomfort.
Students who sought medical treatment generally reported longer periods of difficulty in playing the piano than did students who did not seek treatment. Most students (26, or 87%) that experienced physical discomfort in the hands or arms had to make adjustments in one or more areas of piano playing or stop playing altogether for a period of time. Adjusting practice habits was reported most frequently (38%), followed by adjusting technique (23%), ceasing practice (21%), and changing repertoire (11%). Of those students who had to stop playing, 73% did so for 14 days or less. Eight percent of the students made no adjustments.

Causative Factors

Twenty-eight students (93%) believed that their hand or arm discomfort was caused or aggravated by playing the piano. Fifty-three percent of the students believed that the onset of their physical discomfort coincided with a change in practice routine, technique, or training. Six of these students (39%) mentioned that their discomforts began around the time of a change in the number of hours they practiced. Several students who noted a change in practice hours when their discomforts began also mentioned additional technical factors, including stretching and percussive playing.

Many students (60%) identified piano technique as another change that occurred around the time their upper extremity discomfort developed. Several students reported that they had been practicing specific exercises to improve facets of their technique, including "trying to produce a bigger tone" and "training to strengthen the muscles of the hands." Three students mentioned that playing the piano with tension in the hands and arms contributed to the development of their discomforts. Previous training was thought to be associated with the problems of 2 students.

Nine (60%) of the 15 students who observed that the onset of their discomforts coincided with a change in their piano routine were not aware of any health problem or of any other activity that could have caused or aggravated the condition in their upper extremities. The remaining students, including those who indicated that the onset did not coincide with any change at the piano, felt that a health factor and/or another activity may have been related to the development of their upper extremity discomfort. A calcium deposit in the wrist, slight arthritis and water retention, and back problems were among the health problems considered by 5 students to exacerbate or precipitate their discomfort. Sports (e.g., volleyball, tennis, basketball, push-ups, and aerobics), work (e.g., raking leaves, writing, and housework), and playing the guitar or violin were among the other factors 13 students believed may have contributed to their discomfort.

Discussion

Replication of this study, with a response rate over 50%, is needed to obtain a more reliable figure of the incidence of upper extremity discomfort among piano players. The 31% response rate was a limitation of this study; it was most likely due to the distribution of questionnaires late in the semester and to the indirect distribution methods required by the administrators at several schools. Two factors may be responsible for the relatively high incidence of upper extremity discomfort among the respondents. First, motivation to complete the survey may have been greater among students experiencing upper extremity discomfort than among those with no history of discomfort at the piano. Second, this survey did not ask students to rate the severity of their discomfort. Therefore, this incidence figure included all conditions, from mild to severe, that either recurred or persisted for more than 1 week and that impaired the ability to play the piano.

The results of this study revealed that only half of the piano students who complained of physical discomforts that impaired their ability to play the piano actually sought treatment. Two factors appeared influential in whether or not students sought medical treatment: (a) the type of discomfort experienced and (b) the length of time a student's ability to practice the piano was impaired.

Piano students who experienced discomforts such as fatigue, weakness, and muscle cramp often did not seek treatment. Cramping, for example, was experienced by only 6% of the students who sought medical treatment as compared to 53% of the students who did not seek treatment. How students perceived their physical discomforts may explain this observation. Students may have perceived certain discomforts as less threatening to their physical well-being or may have believed that a certain level of discomfort was an inevitable part of becoming an accomplished musician.

Fifty-eight percent of the students who did not seek treatment stated that their ability to play the piano was impaired for less than 1 month, but only 23% of the students who sought treatment indicated this. This may indicate that discomforts such as muscle cramping or fatigue were more responsive to 1 or 2 days of rest than were the types of discomfort (e.g., tenderness) experienced by the students who sought treatment.

Playing the piano, participating in other activities, and health factors appeared to play a role, either indi-
individually or collectively, in the development of physical discomforts in piano students. The presence of preexisting diseases or medical conditions that may cause discomfort in the upper extremities and impair piano playing was uncommon in this population of pianists. Approximately 50% of the piano students with physical discomfort believed the onset of their upper extremity problems coincided with a change in practice routine, training, or technique, but 33% of these students also suggested that their involvement in other activities could have caused or aggravated their discomfort. The numerous variables involved here underscore the difficulty in determining the etiology of upper extremity discomfort among piano players.

Upper extremity discomfort was noted to appear often in piano students following a change in practice routine. Students may have been particularly susceptible to developing upper extremity discomfort when they found the practice demands at the college level to be far greater than those during their earlier years. In addition, the segmentation of the year into semesters and vacation breaks may have resulted in erratic fluctuations in practice schedules. Kurppa, Waris, and Kokkanen (1979) cited several studies in which an increased incidence of peritendinitis and tenosynovitis were found in beginning industrial workers and in workers returning from holidays. A rapid change in training sessions among athletes was reported as an etiological factor in the development of the same inflammatory conditions (Stanish, 1984).

When physical discomfort develops in the upper extremities of piano students and impairs practice, the piano is automatically suspected as a cause. Another activity in a student’s daily life, however, may be the prime factor in the development of discomfort or may exacerbate an already existing problem. To determine if activities such as tennis, volleyball, and playing the violin contribute to the development of physical discomfort, more information is needed from the students. How accustomed they are to an activity, the frequency with which they participate, the length of time they generally spend on the activity, and their general conditioning would be important indicators of whether or not other activities play a significant role in the development of physical discomfort in individual students. Given the repetitive and strenuous nature of many of the other activities in which students participate, the compound effect of stress from the piano and from other activities needs to be considered.

Conclusion

Occupational therapists can contribute their knowledge and skills to an occupational group whose problems have been relatively neglected among the medical professions until recently. They can assume an important role in screening piano students and other musicians who seek medical treatment by focusing on areas such as upper extremity physical function, practice habits, work and leisure activities, stress factors, and coping mechanisms.

Additional research is needed to determine the incidence of upper extremity injury in musicians, as are studies that correlate repertoire, technique, and practice habits with physical discomfort. Many questions remain about the effectiveness of current treatment in reducing discomfort and preventing its recurrence. Longitudinal studies of musicians during the course of their careers, will help to determine the general progression of inflammatory conditions in the upper extremities and their long-term effects on a musician’s career.

Occupational therapists can contribute their expertise by examining the adaptation strategies of musicians. A study of practice habits, before and after discomfort is experienced, would help establish what role practice habits play in the development of these conditions. The results of this research with musicians might benefit other occupational groups as well.

This study has increased understanding of the frequency and types of upper extremity discomfort in piano students. The results of this preliminary investigation support the need for additional research. Further identification and substantiation of the factors that contribute to discomfort could have a considerable impact on the future careers of many aspiring musicians.

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References


