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Music related upper limb pain in schoolchildren

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SUMMARY Two British secondary schools (one a specialist music school) were surveyed to assess the prevalence of upper limb pain among specialist music students compared with students in a regular school setting. Female students tended to report pain more often than male students, but for both significantly higher prevalence was found in the music school. Pain in the regular school was most often attributed to writing, whereas in the music school it was associated with the playing of all instruments, but most particularly with cello, clarinet, and flute. Music students reported long hours of practice, but it appeared that the intensity of practice may be more important as a determinant of pain than the total hours spent practising. The results of the study are in substantial agreement with those previously published from Australia and North America. On the balance of probabilities the pain is due to overuse syndrome, which is very common in musicians and well known in writers.

Overuse related to music is now well reported in a number of modern studies,[1–4] including one of Australian secondary school children which compares those who play musical instruments with those who do not.[5] A study of children of the same age from Texas reported similar findings.[6] The purpose of our study was to examine the occurrence of music related pain in a unique school in the north of England catering for children from the ages of 8 upwards who are gifted musically, and which provides the general as well as the musical education of these students. This was compared with a 'regular' school in the same region: fee paying, traditional, with a strong music department, and a high standard of pastoral care. The aim of the study was to compare the occurrence and characteristics of upper limb pain among the musically gifted students with that which occurs among other students in the community who may or may not play musical instruments.

Subjects and methods

Questionnaires were distributed to students in the two schools, and responses were received from all 169 students at the music school and all 348 students at the regular school. The students were not physically examined by the medical author. Students' responses were coded and analysed by computer. Where the results involved differences between groups or relations between variables, standard tests of significance were used.

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Results

The distributions of students' ages were very similar in the two schools. Ages ranged from 7 to 19 in the music school (average 14·4) and from 10 to 19 in the regular school (average 14·4). Gender balance was quite different in the two schools: fairly even (52% female) in the regular school, but predominantly female (63%) in the music school. This needs to be kept in mind when comparisons are made between the two schools.

THE MUSIC SCHOOL

All students surveyed played one or more instruments, with 75% playing two or more. Table 1 lists the number and percentage of pupils playing each instrument, in order of their popularity. Because most students played more than one instrument the total number is more than the number of students (169), and the percentages do not add up to 100%. Although the piano was played by many more students than any other instrument, it was played more often as a second instrument (96 students) than as a first instrument (44 students). Violin, on the other hand, was the first instrument for 44 students (equal with piano), but the second instrument for only three. Eighteen students played the cello, and it was the first instrument for all of them.

Table 1 *Instruments played—music school**

Instrument	*Number of pupils*	*Percentage*
Piano	142	84
Violin	48	28
Cello	18	11
Flute	11	7
Clarinet	9	5
Harpsichord	8	5
Viola	7	4
Trumpet	6	4
French horn	6	4
Trombone	6	4
Double bass	5	3
Oboe	5	3
Guitar	5	3
Percussion	4	2
Tuba	4	2
Harpsichord	4	2
Recorder	3	2
(Singing)	3	2
Organ	2	1
Bassoon	2	1
(Composition)	2	1
Saxophone	1	1

*Number of pupils in the music school=169.

No other instruments were played by substantial numbers of students.

Students at this school practise their instruments for long hours, claiming an average 3·3 hours a day. When students were asked to specify their *maximum* practice hours a day, one third indicated that they sometimes practised for more than five hours a day, with half of those exceeding seven hours. The question at issue is whether this has adverse effects in itself.

PREVALENCE OF PAIN

Students in both schools were asked whether they had ever experienced pain in their hands and arms related to hand use. Because of the different emphasis, the question was worded differently in the two schools: (*a*) Music school: Have you ever had pain in your hands and arms that appeared to be related to playing your instrument? (*b*) Regular school: Have you ever had pain in your hands and arms that appeared to be related to hand use such as writing, sport, hobbies, carrying your case?

Thus respondents in the music school were asked to report pain resulting from a narrower range of activities than those from the regular school (because of the focus of this study it was thought desirable to direct attention specifically to music related pain in the music school). Despite this there was a significantly higher prevalence of pain reported in the music school than in the regular school (71% *v* 50%).

Both figures are sufficiently high to cause concern, and the reasons for such high prevalence of pain warrant exploration. In the music school all pain reported was associated with the playing of musical instruments; in the regular school the reported pain was associated with a range of activities. Regular school students were asked what activities produced the pain; Table 2 summarises their responses. Writing was by far the dominant source of hand and arm pain. Over one quarter of all students (and therefore more than half of those who reported pain) attributed it to writing. The various categories of sport accounted for another 10% of the total. Music related pain was quite uncommon (six students, 2%) and contrasted dramatically with the 71% in the music school who reported music related pain. Of other activities mentioned, only pushing and lifting (10 students, 3%) and carrying weights (12 students, 3%) accounted in any substantial way for the occurrence of pain.

Various questions were asked of both groups about the nature and duration of the pain. The median duration reported was two years in the music school and three years in the regular school. Although the range was very large (from one week to 12 years), it was clear that for many students this was a longlasting problem. Table 3 reports the reponses to a series of questions about the nature

Table 2 *Activities that produce pain—regular school**

Activity	*Number of pupils*	*Percentage*
Writing	93	26
Sports	34	10
Music	6	2
Lifting and other heavy physical activity	27	8
Unable to say	10	3
Other	4	1
Total	173	50

*Number of pupils in the regular school=348.

Table 3 *Nature and seriousness of reported pain*

Characteristic of pain	*Music school No (%)*	*Regular school No (%)*	*Significance of difference (p value)*
Pain still present?	83 (49)	91 (26)	<0·0001
Pain even when not using hands?	28 (17)	23 (7)	<0·001
Does pain interfere with schoolwork?	11 (7)	66 (19)	<0·001

and seriousness of the pain. Students in the music school were more likely to be currently experiencing pain than those in the regular school. Because pain in the regular school was so strongly associated with writing and sport it is likely that many were reporting specific occurrences of pain associated with events such as a examinations or sporting events. Students in the music school were referring to problems associated with a continuing activity that occupied a large amount of their time. Because of their commitment to music it is probably more difficult for them to avoid the situations that produce their pain. Nevertheless only 18 of them (15% of those reporting pain) were having treatment.

WHO EXPERIENCES PAIN?

In the regular school there was a significantly higher prevalence of reported pain among girls than among boys (56% *v* 43%; $\chi^2=6{\cdot}1$, df=1, $p<0{\cdot}05$). This might suggest that the higher prevalence of pain in the music school was due to its predominantly female population. The data, however, refute this. Within the music school there was a small but statistically non-significant difference between boys and girls for reported pain (girls 73%, boys 68%; $\chi^2=0{\cdot}02$, df=1). Tables 4 and 5 show that the prevalence of reported pain was significantly higher in the music school than in the regular school, regardless of gender.

Table 4 *Prevalence of pain in music and regular schools—boys*

	Music school No (%)	*Regular school No (%)*	*Total No (%)*
Pain	43 (68)	71 (43)	114 (50)
No pain	20 (32)	96 (57)	116 (50)
Total	63	167	230

$\chi^2=12{\cdot}1$, df=1, $p<0{\cdot}0001$.

Table 5 *Prevalence of pain in music and regular schools—girls*

	Music school No (%)	*Regular school No (%)*	*Total No (%)*
Pain	77 (73)	102 (56)	179 (62)
No pain	29 (27)	79 (44)	108 (38)
Total	106	181	287

$\chi^2=7{\cdot}6$, df=1, $p<0{\cdot}01$.

The large amount of time spent on music seems to exact a price more severe (although perhaps less surprising) than does the time spent writing in the regular school. What activities contribute most to this pain? We shall look at this in more detail next.

INSTRUMENTS PLAYED

We began by assuming that the first instrument nominated by each child was the one to which the most time would be devoted. An initial cross tabulation between the reporting of pain and the first instrument named identified the piano, violin, cello, clarinet, and flute as the instruments most associated with the occurrence of pain. There were others used as first instruments by comparatively few students for which the proportions were high but less convincing because of the smaller numbers. These included the guitar (4/4), harp (4/4), French horn (4/5) and bassoon (3/3). Table 6 records, for the piano, violin, cello, clarinet, and flute, the numbers and proportions of students reporting pain (*a*) when it was their first instrument and (*b*) when the instrument was played at all.

The piano was more often played as a second instrument, but the prevalence of pain was high whether it was first instrument or not. The violin was more often first instrument, and the cello exclusively first. It was found that pain was almost always associated with playing of the cello; less certain because of the smaller numbers, but also of concern, was the high prevalence of pain associated with the clarinet and the flute.

Firm conclusions cannot be reached for instruments where the numbers are small. We considered it worthwhile, however, to look at the prevalence of pain for different categories of instruments, defined as follows: keyboard (piano, organ, harpsichord), strings (violin, viola, cello, bass, guitar, harp), brass (trumpet, trombone, French horn, tuba), and woodwind (clarinet, oboe, flute, bassoon, recorder, saxophone). Table 7 shows the prevalence of pain for those playing each category of instrument. For none of the instrument categories was there a significant difference between the likelihood of pain for those using and not using the instrument. In

Table 6 *Prevalence of pain for selected instruments*

Instrument	*As first instrument*		*Played at all*	
	No	*%*	*No*	*%*
Piano	30/44	68	100/142	70
Violin	28/44	64	32/48	67
Cello	17/18	94	17/18	94
Clarinet	6/7	86	8/9	89
Flute	8/9	89	9/11	82

Table 7 *Prevalence of pain for four categories of instrument*

*Instrument category**	*Number who play*	*No (%) reporting pain*	*Number not playing*	*No (%) reporting pain*
Keyboard	143	101 (71)	26	19 (73)
Strings	90	68 (76)	79	52 (66)
Brass	21	12 (57)	148	108 (73)
Woodwind	32	24 (75)	137	96 (70)

*Keyboard=piano, organ, harpsichord; strings=violin, viola, cello, bass, guitar, harp; brass=trumpet, trombone, French horn, tube; woodwind=clarinet, oboe, flute, bassoon, recorder, saxophone.

interpreting these results, it is important to note that those not using any specified instrument type were using others in its place. Users of all instrument types, except brass, recorded substantially higher rates of reported pain than the children in the regular school.

To conclude, pain was experienced fairly uniformly across the various instrument types, and for all types was substantially higher than for children not engaged in playing musical instruments. The instrument most strongly associated with pain was the cello (17/18), and the group of instruments least associated with pain was brass.

PRACTICE TIME

In view of the long hours of practice reported one might have reasonably expected to find an association between practice time and the prevalence of pain. Two indicators of practice time were available: the stated average hours a day and the stated maximum hours a day. Each was split as near as possible to the median and cross tabulated with the incidence of reported pain. Table 8 presents the results obtained. In each case the longer practice time was associated with greater prevalence of pain, but neither relation achieved statistical significance.

Table 8 *Prevalence of pain and practice hours a day*

	*Average daily practice**		*Maximum daily practice†*	
	3 Hours and less No (%)	*More than 3 hours No (%)*	*Less than 5 hours No (%)*	*5 Hours and more No (%)*
Pain	73 (70)	47 (73)	50 (67)	70 (74)
No pain	32 (30)	17 (27)	25 (33)	24 (26)
Total	105	64	75	94

*χ^2=0·3, df=1, NS.
†χ^2=1·2, df=1, NS.

The relation was stronger for maximum practice hours than for average practice hours, suggesting that periods of intense practice may be a stronger determinant of pain than the average level of practice. This warrants further investigation, given the tentative statistical evidence.

GRADE LEVEL

Although the prevalence of pain was constant across ages, it was considered that pain might be related to the grade level reached in music, but the evidence for this was unconvincing. The lowest prevalence of pain was among those with the lowest grade levels, and the highest prevalence among those at grade levels 9 and 10. Although the trend was in the expected direction, it fell short of statistical significance.

Discussion

The prevalence of writing related pain was twice as high in the control group in this study as that reported previously in the Australian study.[5] In this study, however, writing related pain was significantly more common among the female than among the male population. Evidence of a gender difference for music related pain[5 7] also existed among the music school pupils, but did not reach statistical significance. The data suggest that the critical factor may be the intensity of practice rather than just the actual hours spent practising. This is supported by the observation that music related overuse may start with one particular work which is particularly demanding, while initially other works do not cause pain. Observations on the events preceding the first symptoms in many of these patients suggest the importance of the increased intensity of practice.

Traditionally, musicians feel that they have to practise to the point of pain to achieve maximum benefit ('No pain, no gain'). This dictum is particularly dangerous in young people as the point will come when the pain no longer disappears with rest and the musical career is threatened.

The music school students, who are carefully monitored medically, reported no morning stiffness or joint swellings. The pain reported would have to be the common musculoligamentous pain of overuse syndrome, very common in musicians. This is a condition of pain and loss of function in muscle groups and ligaments due to excessive or unaccustomed use. Although the intensity multiplied by the time of practice is probably the most important factor, the musician's technique, if tense and involving excessive and wasteful muscular effort, may also contribute. Apparently some individuals are genetically more vulnerable to overuse than others.[3 8]

Conclusion

Last century both the painful and the painless forms of overuse were most commonly brought about by writing.[9] The data here, showing 26% of the regular school population affected by writing related pain, are cause for concern and worthy of further investigation, as is the apparently greater vulnerability of girls. Techniques of writing, including the avoidance of unnecessarily excessive muscle power, should probably be taught in primary schools.

The music related pain reported by the gifted music students is cause for particular concern, and, in the absence of other identifiable pain causing processes, is almost certain to be overuse syndrome. Students with persisting pain and pain at rest indicate a worse grade of the disorder in which the musculoskeletal structures have not been able to recover from the high demand. Theoretically, all overuse should be preventable by the control of use and by segmentalised controlled practice; the proper use of muscle power for posture and support of the instruments needs to be addressed if these high figures are to be reduced. The repertoire should be chosen for the student's present ability. Above all, students should be taught not to practise through pain as has been the custom in the past.

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