

The influence of the active range of movement of pianists' wrists on repetitive strain injury

M. Rosety-Rodriguez, F.J. Ordóñez, J. Farias, M. Rosety, C. Carrasco, A. Ribelles, J.M. Rosety and M. Gómez del Valle

Escuela de Medicina de la Educación Física y el Deporte, Universidad de Cádiz, Cádiz, Spain

SUMMARY

In the present work we studied the mobility of young pianists' wrists to predict their potential vulnerability to suffer from Repetitive Strain Injury (RSI).

First, we observed that 222 individuals out of the 341 pianists studied (65.1% of the total) presented or had presented RSI. Second, from among affected performers we chose those that were younger than 16 years old (67 individuals) to analyse the active range of motion (AROM) of their wrist joints.

Our results indicated that hypermobility of joints such as the wrists may be an asset in piano playing. In this respect, pianists that could perform both maximal flexions and extensions were rarely affected by RSI. In addition we observed that the individuals able to perform maximal extensions were more resistant to RSI than those that merely performed maximal flexions.

To solve this situation of discrimination and inadaptation, which may bring misery to many pianists, the creation of a new repertoire would be recommendable, as well as the use of an integrative teaching regimen that considers performers to be able to adapt individually instruction systems to the individual's morphotype. It is noted that further studies in this area are required to reduce the incidence of playing-related medical problems in general, and RSI in particular, in pianists population.

Key words: Musicians – Pianists – Repetitive strain injury – Active range of movement – Wrists

INTRODUCTION

Our hands and arms can move in many ways, but some ways of moving place extra stress on the tendons and other soft tissues. If a person moves in a stressful way, and does this repeatedly over a long period of time, the vulnerable structures may be injured.

In this respect, repetitive strain injuries (RSI) are defined as cumulative trauma disorders resulting from repetitive, forceful or awkward movements (Nainzadeh et al., 1999). They are among the most common and disabling impairments in the working population and represent an important health care problem for industry given, since they consume considerable resources as regards medical care, absence from work, productivity losses and compensation benefits (Schultz, 1996). Accordingly, in 1989 the total U.S. workers' Compensation costs for upper-extremity repetitive stress injuries were estimated to be \$ 563 million (Webster and Snook, 1994).

Current medical research relates this pathological condition to occupations that require overexertion of the fingers and wrists such as computer workers (Dembe, 1999), supermarket checkout cashiers (Silverstein et al., 1986), grocery checkers (Ossorio et al., 1994) and letter carriers (Wells et al., 1983), among others.

Instrumental musicians in general, and pianists in particular, are also a special risk group for repetitive motion injuries. In most cases the injury does not end a person's professional career, but it forces cancellations of concerts or

Correspondence to:
Manuel Rosety, Escuela de Medicina de la Educación Física y el Deporte, Universidad de Cádiz, Pza. Frágela s/n, 11003 Cádiz, Spain.
Phone: 34 956 015201; Fax: 34 956 015254. E-mail: manuel.rosety@uca.es

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tours, or restrictions of repertoire since injuries can lead to permanent damage if left untreated. In any case this is a tragic situation, since injuries are preventable and curable (Rozmaryn, 1993; Yassi, 2000). In this respect it should be mentioned that among the main topographies of overuse syndrome are the wrists and hands (Brandfonbrener, 1990).

For the above reasons, this experimental study was designed to predict the potential vulnerability of pianists to suffer from RSI by means of an analysis of the range of movement of their wrist joints. Once we had identified vulnerable individuals, we would be able to adapt technical instruction to each taking into account their potential weakness, in order to reduce the incidence of RSI in pianists.

MATERIAL AND METHODS

This investigation took place between 1993 and 1999 at the Morphological Sciences Department of the School of Medicine of Cadiz (Spain). The study population was a group of 341 pianists, both professionals and students from several techniques and schools (150 men and 191 females). They all were between the age of 8 and 70. Firstly, we determined the incidence of RSI in the total group. And secondly, we selected from among affected performers those that were less than 16 years old in the order to analyse the range of motion of their wrist joints.

A muscle attaches to the bone it moves by means of a tendon, and the tendon passes over a joint (or several joints). The relative position of the bones will influence the efficiency of the tendon in transmitting the muscular force to the part moved, especially in cases like the fingers where the tendon passes over several joints. The mid-range position of the wrist, with the wrist in a straight line with the forearm, gives the greatest mechanical advantage to the fingers. Deviating from this neutral position by means of flexion or extension results in a loss of grip strength that may lead individuals to suffer from RSI.

In this sense, one of the most important aspects during the development of piano technique is the Active Range of Motion (AROM) of the wrist joint. To classify individuals according to it we studied the possibility of obtaining maximal flexion and extension of their wrists while the elbow of each participant was moved in 90° flexion. In agreement with Swanson et al. (1989), we considered that the natural range of movement of the wrist was between 80° of flexion and 70° of extension. In relation to this classification, we obtained three general types of wrist joints:

- a) AROM type A: wrists that could perform maximal extensions (70°) but no maximal flexions.
- b) AROM type B: wrists that could perform maximal flexions (80°) but no maximal extensions.

- c) AROM type C: wrists that could perform both maximal extensions (70°) and flexions (80°).

It should be mentioned that we determined the range of movements by means of a clinical goniometer (Bodycare HRF™).

RESULTS

From the total population studied (341 pianists), 222 individuals (65.1%) presented or had presented RSI. The distribution by sex among the injured was as follows: 151 females (68%) and 71 males (32%). From the total of affected performers (151 individuals), we selected those under 16 years old (68 individuals). The distribution by sex was 46 females and 21 males.

With regard to the range of mobility of affected wrist joints, we observed that 28 (41.7%) were AROM type A; 36 (53.8%) were AROM type B, and finally 3 (4.5%) were AROM type C wrist joints. Among the type A wrists, 75% were females whereas 25% were males. In addition, 60.7% of the individuals who presented type B wrists were females whereas 39.3% were males. Finally, we observed that 66.7% of type C wrists were females whereas 33.3% were males.

DISCUSSION

Music has been always associated with well-being, emotional balance, and recreation. However, it is now recognised that musicians may develop health problems derived from their occupation and lifestyle, some of which threaten or end their careers.

Thus, several studies have shown that a significant proportion of these instrumentalists report musculoskeletal problems severely affecting their musical performance (Caldron, 1988; Fry, 1987; Middlestadt and Fishbein, 1988; Rozmaryn, 1993). In this line, we observed that 65.1% of the population of pianists studied were affected by RSI. In contrast to De Oliveira (1999), the high incidence of RSI in pianists is better explained as a consequence of accumulated repetitive trauma incurred during years of piano playing.

Thomas and Biltz (2000) reported that physicians must not only correctly diagnose specific musculoskeletal injuries but also pay attention to factors that predispose the patient to injury. To get this goal, and in agreement with Fry (1986) and Potter and Jones (1991), we considered that knowledge of the interaction between the technique of playing and the particular musician can help physicians to solve these problems.

In agreement with Pascarelli and Hsu (2001) we believe that evaluation of the joint range of motion may play an important role in piano playing as well as preventing of upper-extremity disorders (musculoskeletal overuse).

Leijnse (1997) reported RSI that may arise when the constraint to movement resulting from the anatomic limitations impede playing movements with sufficiently low energy expenditure. With this in mind, and in agreement to the results proposed previously by Larsson et al. (1993), it seems that among musicians who play instruments requiring repetitive motion, hypermobility of joints such as the wrists may be an asset in piano playing. This may explain why most of affected performers presented a limited extension or flexion (95.5% of them) (types A and B) whereas we only found 3 affected pianists that could perform both maximal flexion and extension (4.5%) (type C). According to our results it also seemed that pianists that could perform maximal extensions were more resistant to RSI than those that could not.

This study was focussed on affected pianists under 16 years old because early detection of youth at risk for RSI is crucial for prevention and treatment (Kidd et al., 2000).

With regard to the distribution by sex, we observed 68.6% of the young population affected were females. Thus, our results are in keeping with the studies of Manchester (1988), Lokwood (1989) and Zaza and Farewell (1997) who reported a predominance of health problems in females.

The classic repertoire was composed by composers to be performed by themselves. In addition, the orthodox instruction in piano technique consider the individual as a standard product. To solve this situation of discrimination and inadaptation that may bring misery to many pianists, it would be recommendable to create of a new repertoire, as well as the use of an integrated teaching regimen that considers performers individually in order to be able to adapt the instruction systems to the individual's morphotype.

For all these reasons, it may be concluded that while RSI is unfortunately common, it not necessarily an unavoidable part of being a musician. In this respect, anthropometrical analysis of pianists' hands considering the range of mobility of their wrists may be used to reduce the high incidence of this illness given that it may predict performer's potential vulnerability to RSI.

It should also be noted that further studies in this area are required to reduce the incidence of playing-related medical problems in general, and RSI in particular, in the pianist population. This is particularly appropriate because musicians are not very aware of the medical problems they may have even though these disturbances may terminate or drastically alter their careers.

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