Playing a 6.0-inch octave keyboard reduces finger extensor activity in pianists with smaller hand spans

Craig Turner[1,2], Robin Mailly[1,2], Justine Pelletier[3], Fabien Dal Maso[1], Mickaël Begon[1], Felipe Verdugo[1,2]
[1]Laboratoire de Simulation et Modélisation du Mouvement, École de Kinésiologie et des Sciences de l'Activité Physique, Université de Montréal, Québec, Canada
[2]Centre de Recherche Interdisciplinaire en Réadaptation, Université de Montréal, Québec, Canada
[3]Faculté de musique, Université de Montréal, Montréal, Québec, Canada
Email: craig.turner@umontreal.ca

Summary

Musculoskeletal injury rates are high in the forearms of pianists. It is unclear from previous research whether a subtly reduced keyboard (6.0" octave vs. 6.5" octave) lowers risk of injury for pianists with small hands, which is a known risk factor. This study examined how both keyboard size and hand anthropometry influence pianists' forearm muscle activity. Posterior forearm high density electromyography showed that mean muscle activations were greater for the smaller- compared to the larger-hand span pianists when playing on a conventional keyboard. Notably, activity of ulnar- and radial-side electrodes decreased when smaller-hand pianists played on the 6.0" octave keyboard. Playing a 6.0" octave keyboard might help reduce exposure to risks of injury in finger/wrist extensor muscles in pianists with smaller hand spans.

Introduction

Up to 82.6% of professional pianists suffer from performance-related musculoskeletal disorders, with the forearms and wrists commonly affected [1]. Having a small hand size is a risk factor especially when playing loud and fast large handspan chords [2]. Ergonomically smaller keyboards are recommended to help pianists with smaller hands. To date, one study found no changes in finger/wrist flexor and extensor muscle activation when playing chords on a 5.5" octave keyboard (octave = 8 notes) compared to a conventional keyboard (6.5" octave) [3]. On the contrary, another study found a reduction in forearm muscle activation on a 5.5" octave keyboard while there were no clear differences for a 6.0" octave keyboard in comparison to a conventional keyboard [4]. It is unclear whether playing on a 6.0" octave keyboard can reduce forearm muscle activation. The objective of this study was to determine the effect of *i*) keyboard size (conventional vs 6.0" octave keyboards) and *ii*) hand anthropometry on pianists' forearm muscle activation when playing fast, large chords at different sound intensities.

Methods

Twenty-four pianists performed an excerpt of the repertoire comprising fast chords encompassing an octave in both loud and soft conditions. All participants played on a conventional keyboard while the fourteen smaller hand pianists also performed on a 6.0" octave keyboard. Surface electromyography (EMG) (Delsys) recorded right brachioradialis (BR), flexor digitorum superficialis (FDS), and flexor carpi ulnaris (FCU) activity. A high-density EMG grid (64 electrodes; TMSi) recorded posterior forearm muscle activity. Participants were grouped into "small" (<20.3 cm) and "large" (>21.2 cm) hand span groups based on criteria used in previous studies. A series of 2-way ANOVAs examined the effects of anthropometry/loudness and keyboard/loudness on mean muscle activations over time.

Results and Discussion

There was no interaction for all muscles. BR, FDS, and FCU showed only a significant loudness effect. Posterior forearm activity was greater for the smaller compared to the larger hand span group when playing on the conventional keyboard (Figure 1). Notably, activity of ulnar- and radial-side electrodes decreased when smaller pianists played on a 6.0" octave keyboard. These findings contrast with a previous study that reported no differences between 6.0" octave and conventional keyboards [4].

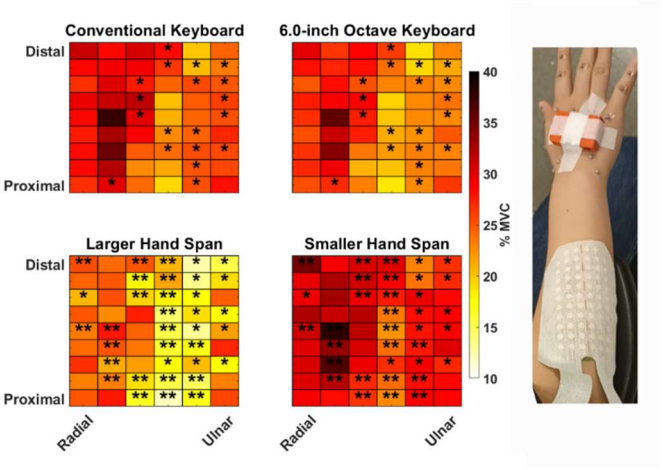

Figure 1: Right posterior forearm mean activations across loud and soft conditions for the keyboards (top row) and anthropometric groups (bottom row). FDR correction: *q<0.05; **q<0.01.

Conclusions

Playing on a 6.0" octave keyboard may help pianists with smaller hands reduce their exposure to risks of injury by decreasing finger/wrist extensor muscle activation when performing fast passages with chords encompassing an octave, which are prevalent in piano repertoire.

References

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