Performance measures in pianists: A method of enhancing communication with clinicians

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Pianists with clinical symptoms in the upper limbs can be a challenge for the medical practitioner. Meticulous history taking and clinical examination along with relevant investigations are essential in the diagnostic process. It is important, however, to also assess the technical elements of piano playing and correlate these to the clinical features. We used digital recording (MIDI), video filming, and surface electromyography to look at the biomechanical elements of playing. The system that provided this multimodal assessment was ProformaVision®. We recruited 10 pianists with various clinical presentations and assessed them with ProformaVision® while they performed basic technical tasks on the keyboard. We interpreted the visual recordings and graphs using measures for each modality and expressed these symbolically and numerically on a chart that enabled us to see the pianist’s technical elements at a glance. Our participants were not enough to give us statistical results and this research remains in progress. These preliminary charts, however, give us the opportunity to envisage creating a method of communication between musician and clinician and promise to become a useful tool in the monitoring of rehabilitation and recovery from injury.

Keywords: communication; rehabilitation; biofeedback; technique; pianists

Various authors have written and discussed the importance of the physiologic hand position at the piano. “Performance-related injury might stem from a misunderstanding of human physiology and the physiologic aspects of playing a musical instrument” (Parr 1988, p. 100). There have been studies on the curved hand and the neutral wrist position, the correct muscle recruitment

Amadio and Russotti (1990) also stated that “one of the most difficult barriers for many physicians is the understanding of professional terminology and perspectives” (p. 405). The same concept was enhanced in 1995 by Newmark and Weinstein who extended the importance of standardizing language between specialists when treating musicians.

Musical instrument digital interface (MIDI) data can be used to analyze technique and document and quantify impairments (Salmon and Newmark 1989). Kjelland (2000) used electromyography for research, observation, diagnosis, comparison of techniques, and biofeedback. Wristen (2000) used video analysis to look at movements that can potentially be harmful. It was Riley et al. (2005) who used the triple modality of MIDI, surface EMG, and video combined and they concluded that this method, using the new system ProformaVision®, provided extensive information concerning performance physiology and helped identify and correct technical issues.

ProformaVision® was also used for this current study. We aimed to (1) identify physiologic measures that can be scientifically used to evaluate piano performance and (2) design a comprehensive chart that can potentially bridge communication between clinicians and musicians and assist clinicians in their understanding of technique elements.

METHOD

Participants

We recruited 10 pianists between 22-55 years (6 female and 4 male), mean age 43.7 years with variable symptomatology and level of performance.

Materials

We used the MIDI, surface EMG, and video multimodal system of ProformaVision® which analyzes all three modalities simultaneously. This system includes hardware and software including a PC and monitor, DynaVision dynamic surface electromyography, and a SoloVision computer interface. For the MIDI keyboard we used a Yamaha Portable Grand DGX-640. Two Logitech C910 web cameras recorded arm and hand movements.

Procedure

Surface EMG electrodes were applied over the examined muscle groups of the forearm extensors/flexors and the upper trapezius. On the monitor we viewed
and assessed the MIDI representation, the video of both hands on the keyboard, and the rectified EMG pattern of muscle activity.

The participants performed 8 tests for each hand that represent basic elements of piano technique (baseline rest/contraction, scales, arpeggios, chords, octaves, and thirds). We recorded 5 measures for each modality. For MIDI we recorded Articulation, Force, Tempo, Temporal Equality, and Pattern. For the surface EMG we recorded Maximum Contraction Extensors, Minimum Contraction Extensors, Maximum Contraction Trapezius/Flexors, Minimum Contraction Trapezius/Flexors, and Tension/Release Cycle. For the video we recorded the Elbow Angle, the Wrist Angle, the Metacarpophalangeal Joint Position, the Interphalangeal Joint Position, and any Dystonic Movement. An M.E.V. (MIDI, EMG, Video) chart was designed to record all measures. This chart comprehensively profiles the pianist’s performance. We added a descriptive M.E.V. report to facilitate further communication with the clinician.

RESULTS

Figures 1 and 2 present a sample (2 out of 10) of our M.E.V. charts and M.E.V. reports.

DISCUSSION

Performing Arts Clinics provide a specialized service with understanding of the peculiarities of the instrumentalist’s technical applications. Closer assessment of basic instrument technique should become an integral part of the consultation and, in conjunction with subjective and objective examinations and clinical investigations, it can give the clinician a more complete profile of their musician-patient.

The methods of MIDI representation, EMG recording, and video filming independently or in combination have been reported in studies for the purpose of assessing musician’s technique (Merriman et al. 1986, Berque and Gray 2002, Jabusch et al. 2004, Riley et al. 2005, Lai et al. 2008). The consensus seems to be that there is need for more progress and more research to validate their use and accuracy. As these methods can be musician-friendly and non-invasive if surface EMG is used, they could become the ancillary methods of assessment in the clinical setting. We used the ProformaVision® multimodal system for our study aiming to see whether accumulating data from all three modalities can give the clinician enough information to understand their patient’s technical profile in order to correlate this to clinical
Figure 1. This chart corresponds to a pianist with diagnosed Focal Dystonia of the right hand. The chart shows the left hand (on the left) and the right hand (on the right) and it presents the performance measures of each test and for each mode of M.E.V. assessment: The red recordings are considered to fall outside the expected range and they are further described in the M.E.V. report. In the right hand we recorded overlap of the 2nd over 3rd finger in ascending scales (MIDI), high activation of the extensors throughout and high activation of the flexors in scales and thirds (EMG), and flat fingers with collapsed transverse arch along with dystonic elements (video). (See full color version at www.performancescience.org.)

findings, aid in the diagnostic process, and serve as an evaluation tool during treatment and rehabilitation.

Having to view multiple recordings on playback or even a significant number of still pictures can be time consuming for the clinician. In this study we designed a MIDI-EMG-VIDEO (M.E.V.) chart where the assessor can record all the measures after viewing the recordings. A written descriptive report is included on the same chart as a summary of the measures, highlighting the prominent features of the M.E.V. assessment. Arranging the assessment over a chart format would give the clinician a general appreciation of the pianist’s physiologic engagement while the chart can be kept within the medical records and could become a means of comparison for future assessments.

Our results are preliminary and serve as a platform for further research.
Figure 2. This chart corresponds to a pianist with left shoulder and arm pain, with left hand on the left and right hand on the right. In the left arm we recorded normal MIDI, high activation of extensors and trapezius throughout (EMG), and transverse arch collapse in arpeggios, octaves, and chords and collapse of the 4th and 5th metacarpophalangeal joints in scales and thirds (video). An unexpected controlled dystonic element of the 5th finger in arpeggios was also noted and recorded. (See full color version at www.performancescience.org.)

We are not able to show any trends or statistical correlations at this stage as more volunteers are needed in order to validate these measures. Our results are a paradigm of how these assessments and charts can potentially bridge the clinician-pianist distance of communication rather than a reflection of true normal and abnormal values.

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References


