
Musikphysiologie und Musikermedizin in anderen Publikationen

Englischsprachige Abstracts

Differences of respiratory kinematics in female and male singers – A comparative study using dynamic magnetic resonance imaging

TRASER L, SCHWAB C, BURK F, ÖZEN AC, BOCK M, RICHTER B, ECHTERNACH M

Front. Psychol. 2022; 13:844032.

<https://doi.org/10.3389/fpsyg.2022.844032>

Abstract: Breath control is an important factor for singing voice production, but pedagogic descriptions of how a beneficial movement pattern should be performed vary widely and the underlying physiological processes are not understood in detail. Differences in respiratory movements during singing might be related to the sex of the singer. To study sex-related differences in respiratory kinematics during phonation, 12 singers (six male and six female) trained in the Western classical singing tradition were imaged with dynamic magnetic resonance imaging. Singers were asked to sustain phonation at five different pitches and loudness conditions, and cross-sectional images of the lung were acquired. In each dynamic image frame the distances between anatomical landmarks were measured to quantify the movements of the respiratory apparatus. No major difference between male and female singers was found for the general respiratory kinematics of the thorax and the diaphragm during sustained phonation. However when compared to sole breathing, male singers significantly increased their thoracic movements for singing. This behavior could not be observed in female singers. The presented data support the hypothesis that professional singers follow sex-specific breathing strategies. This finding may be important in a pedagogical context where the biological sex of singer and student differ and should be further investigated in a larger cohort.

An etude for post-pandemic practice: The impact of the COVID-19 pandemic on practice methods and instrumental technique

FALLOWFIELD E, GOMEZ P

Front Psychol. 2022; 13:846953.

<https://doi.org/10.3389/fpsyg.2022.846953>

Abstract: This paper considers how the pandemic-related concert-free time affected musicians' practice, specifically in relation to technique. A semi-structured interview was carried out on 22 musicians based in Switzerland (11 males, 11 females; 7 students, 15 non-students; 11 with school-aged children, 11 without school-aged children; 16 with teaching duties and 6 non-teachers). The amount of practice during the pandemic-related concert-free time was reported as different to usual by 91% and usual for only 9% of participants ($p = 0.002$). Forty-one percent of participants reported reduced, and 41% "fluctuating" amounts of practice. The proportion of practice time spent on technique was reported by 55% of participants to have increased and by only 9% to have decreased ($p = 0.019$). Of those who reported an increase in technique practice, 75% agreed this had a positive impact on technique, and only 8% disagreed ($p = 0.037$). Moreover, 58% considered this work to have changed their current

and future practice. Participants were statistically more likely to report “never” watching online tutorials than “often” ($p=0.014$), but, of those that did watch such material, 75% agreed that it had a positive impact upon their practice. Most participants created digital content during this period; only 5% produced no such material. An increased use of digital tools was reported by 55% of participants, 92% of whom described this as having a positive effect upon practice and only 8% were unsure ($p=0.022$). However, in the unstructured discussion, the use of digital tools appears to be associated with mixed outcomes. Men reported significantly more frequent use of digital tools (91% vs. 45% describing this use as often, $p=0.038$) and spent a larger proportion of time on technique relative to their pre-pandemic habits than women ($p=0.065$); moreover, a trend indicated that more women than men created digital content in the form of tutorials ($p=0.095$). The exceptional situation musicians experienced during the pandemic, which introduced new aspects to musical instrument practice, and accelerated changes already underway, could lead to future work that improves practice under “normal” conditions, and exposes discrepancies between certain demographic groups.

Determining factors for compensatory movements of the left arm and shoulder in violin playing

MARGULIES O, NÜBLING M, VERHEUL W, HILDEBRANDT W, HILDEBRANDT H

Front Psychol. 2023; 13:1017039.

<https://doi.org/10.3389/fpsyg.2022.1017039>

Abstract: INTRODUCTION: Despite a large number of available ergonomic aids and recommendations regarding instrument positioning, violin players at any proficiency level still display a worrying incidence of task-specific complaints of incompletely understood etiology. Compensatory movement patterns of the left upper extremity form an integral part of violin playing. They are highly variable between players but remain understudied despite their relevance for task-specific health problems.

METHODS: This study investigated individual position effects of the instrument and pre-existing biomechanical factors likely determining the degree of typical compensatory movements in the left upper extremity: (1) left elbow/upper arm adduction (“Reference Angle α ”, deviation from the vertical axis), (2) shoulder elevation (“Coord x”, in mm), and (3) shoulder protraction (“Coord y”, in mm). In a group of healthy music students ($N=30$, 15 m, 15 f, mean age = 22.5, SD = 2.6), “Reference Angle α ” was measured by 3D motion capture analysis. “Coord x” and “Coord y” were assessed and ranked by a synchronized 2D HD video monitoring while performing a pre-defined 16-s tune under laboratory conditions. These three primary outcome variables were compared between four typical, standardized violin positions varying by their sideward orientation (“LatAx-CSP”) and/or inclination (“LoAx-HP”) by 30°, as well as the players’ usual playing position. Selected biomechanical hand parameter data were analyzed as co-factors according to Wagner’s Biomechanical Hand Measurement (BHM).

RESULTS: Mean “Reference Angle α ” decreased significantly from 24.84 ± 2.67 to $18.61 \pm 3.12^\circ$ ($p < 0.001$), “Coord x” from 22.54 ± 7.417 to 4.75 ± 3.488 mm ($p < 0.001$), and “Coord y” from 5.66 ± 3.287 to 1.94 ± 1.901 mm ($p < 0.001$) when increasing LatAx-CSP and LoAx-HP by 30°. Concerning the biomechanical co-factors, “Reference Angle α ”, “Coord y”, but not “Coord x”, were found to be significantly increased overall, with decreasing passive supination range ($r = -0.307$, $p < 0.001$ for “Passive Supination 250 g/16Ncm”, and $r = -0.194$, $p < 0.001$ for “Coord y”). Compensatory movements were larger during tune sections requiring high positioning of the left hand and when using the small finger.

DISCUSSION: Results may enable to adapt individually suitable instrument positions to minimize strenuous and potentially unhealthy compensation movements of the left upper extremity.

Orofacial Pain, Musical Performance and Associated Coping Behaviors, Psychological Distress and Disability among Asian Young Adults

NAIR R, TANIKAWA C, FERREIRA JN

J Clin Med 2023; 12(4):1271.

<https://doi.org/10.3390/jcm12041271>

Abstract: Musicians often report orofacial pain (OFP) and performance-related psychological distress related to occupational neuromuscular overuse, but to date, no study has been performed in Asian musicians to assess these factors. This study evaluated OFP, psychological distress, coping behaviors, and disability among Asian musical performers. A total of 201 participants in Singaporean music ensembles were surveyed from which 159 met the inclusion criteria for vocalists or instrumentalist musicians (mean age 20.26 ± 2.20 years). Self-administered questionnaires assessed musical practices, jaw/neck pre-conditioning exercises, pain-related temporomandibular disorders (TMD), OFP descriptors, pain chronicity and disability, coping behaviors and psychological distress. Univariate and multi-variate analyses were carried out. OFP, while performing, was more than two-fold higher in instrumentalists when compared to vocalists (41.4–48% vs. 17.2%, $p = 0.002$). A similar trend occurred for OFP that progresses while playing ($p = 0.035$) and for persistent OFP that reduces playing ($p = 0.001$). There were no differences in psychological distress, pain coping and disability between groups. Vocalists were found to practice jaw/neck pre-conditioning exercises more frequently (75% vs. 4–12.9% in instrumentalists, $p < 0.0001$). While performing, Asian vocalists reported less OFP when compared to instrumentalists. Future prospective studies are needed to confirm if pre-conditioning exercises play a protective role against OFP in vocalists.

Movement patterns in tuba playing: comparison of an embouchure dystonia case with healthy professional tuba players using real-time MRI imaging

NELKENSTOCK R, ILTIS PW, VOIT D, FRAHM J, PASSAROTTO E, ALTENMÜLLER E

Front Neurol 2023; 14:1106217.

<https://doi.org/10.3389/fneur.2023.1106217>

Abstract: INTRODUCTION: Musculoskeletal problems in professional brass musicians are very common and often involve the muscles of the embouchure. In rare cases, embouchure dystonia (EmD), a task-specific movement disorder with a wide symptomatic and phenotypic variability, occurs. Following trumpeters and horn players, professional tuba players with and without EmD have now been studied using the latest real-time MRI technology to better understand the underlying pathophysiology.

MATERIALS AND METHODS: In the present study, the tongue movement patterns of 11 healthy professional artists and one subject suffering from EmD were compared. The tongue position in the anterior, intermediary and posterior oral cavity were converted into pixel positions based on seven previously generated profile lines, using the established software MATLAB. These data allow a structured comparison of tongue movement patterns between the patient and the healthy subjects, as well as between individual exercises. The main focus of the analysis was on an ascending 7-note harmonic series performed in different playing techniques (slurred, tongued, tenuto and staccato).

RESULTS: Playing the ascending harmonics, a noticeable ascending tongue movement could be observed in the anterior part of the oral cavity in healthy tubists. In the posterior region, there was a slight decrease in oral cavity space. In the EmD patient, hardly any movement was observed at the tongue apex, but in the middle and posterior regions of the oral cavity there was an increase in size the higher the tone became. These distinct differences

are relevant for the characterization and a better understanding of the clinical presentation of EmD. Concerning different playing techniques, it was apparent, that notes played slurred or staccato resulted in a larger oral cavity when compared to notes played tongued or tenuto, respectively.

CONCLUSION: By using real-time MRI videos, the tongue movements of tuba players can be clearly observed and analyzed. The differences between healthy and diseased tuba players demonstrate the great effects of movement disorders in a small area of the tongue. In order to better understand the compensation of this motor control dysfunction, further studies should investigate further parameters of tone production in all brass players with a larger number of EmD patients additional to the observed movement patterns.

Long-Term Muscular Atrophy and Weakness Following Cessation of Botulinum Toxin Type A Injections in the Flexor Digitorum Muscle of Musicians with Focal Hand Dystonia

IOANNOU CI, HODDE-CHRISKE FL, ALTENMÜLLER E

Toxins (Basel) 2023; 15(4):296.

<https://doi.org/10.3390/toxins15040296>

Abstract: The present study assessed muscular atrophy and weakness of the flexor digitorum superficialis (FDS) and profundus (FDP) muscle as possible long-term side effects of botulinum toxin (BoNT) injections in hand dystonia patients after the termination of their treatment. For the assessment of both parameters, a group of 12 musicians diagnosed with focal hand dystonia was compared with a group of 12 healthy matched musicians. The minimum and maximum times since the last injection across patients were 0.5 to 3.5 years, respectively. The thickness and strength of the FDS and FDP were assessed via ultrasonography and a strength measurement device. Group differences were estimated through the calculation of the symmetry index between the dominant and non-dominant hand. The results revealed that compared to the control group, thickness and flexion strength of the injected FDS and FDP were decreased by $10.6\% \pm 5.3\%$ (95% CI) and $12.5\% \pm 6.4\%$ (95% CI), respectively, in the patient group. The amount of weakness and atrophy was predicted significantly by the total amount of BoNT injected throughout the entire treatment period. In contrast, the time after the last injection did not predict the amount of strength and muscle mass recovery after the cessation of the treatment. The current study revealed that even up to 3.5 years after the termination of BoNT injections, long-term side effects such as weakness and atrophy can still be observed. We suggest that the total BoNT dose should remain as small as possible to reduce long-lasting side effects to the minimum. Although side effects differ significantly among patients, a potential full recovery of atrophy and weakness after the cessation of BoNT treatment might be observed after periods longer than 3.5 years.

The influence of proximal motor strategies on pianists' upper-limb movement variability

TURNER C, GOUBAULT E, DAL MASO F, BEGON M, VERDUGO F

Hum Mov Sci 2023; 90:103110.

<https://doi.org/10.1016/j.humov.2023.103110>

Abstract: Repetitive movements are considered a risk factor for developing practice-related musculoskeletal disorders. Intra-participant kinematic variability might help musicians reduce the risk of injury during repetitive tasks. No research has studied the effects of proximal motion (i.e., trunk and shoulder movement) on upper-limb

movement variability in pianists. The first objective was to determine the effect of proximal movement strategies and performance tempo on both intra-participant joint angle variability of upper-limb joints and endpoint variability. The second objective was to compare joint angle variability between pianist's upper-limb joints. As secondary objectives, we assessed the relationship between intra-participant joint angle variability and task range of motion (ROM) and documented inter-participant joint angle variability. The upper body kinematics of 9 expert pianists were recorded using an optoelectronic system. Participants continuously performed two right-hand chords (lateral leap motions) while changing movements based on trunk motion (with and without) and shoulder motion (counter-clockwise, back-and-forth, and clockwise) at two tempi (slow and fast). Trunk and shoulder movement strategies collectively influenced variability at the shoulder, elbow and, to a lesser extent, the wrist. Slow tempi led to greater variability at wrist and elbow flexion/extension compared to fast tempi. Endpoint variability was influenced only along the anteroposterior axis. When the trunk was static, the shoulder had the lowest joint angle variability. When trunk motion was used, elbow and shoulder variability increased, and became comparable to wrist variability. ROM was correlated with intra-participant joint angle variability, suggesting that increased task ROM might result in increased movement variability during practice. Inter-participant variability was approximately six times greater than intra-participant variability. Pianists should consider incorporating trunk motion and a variety of shoulder movements as performance strategies while performing leap motions at the piano, as they might reduce exposure to risks of injury.

Music performance anxiety: the role of early parenting experiences and cognitive schemas

KIRSNER J, WILSON SJ, OSBORNE MS

Front Psychol 2023 14:1185296.

<https://doi.org/10.3389/fpsyg.2023.1185296>

Abstract: Performance Anxiety (MPA) is a common challenge for classical musicians, however its etiology has received minimal research, particularly in regards to caregiver experiences during childhood and adolescence. The aim of this research was to explore the impact of childhood experiences with parents along with patterns of dysfunctional cognitive schemas that develop through childhood ('Early Maladaptive Schemas'; EMSs) on the manifestation and severity of MPA in adulthood. Study 1 employed 100 adult professional, amateur, and tertiary student classical musicians from across Australia. Participants completed the Young Schema Questionnaire (YSQ) and the Kenny Music Performance Anxiety Inventory (K-MPAI). Study 2 included eight participants from Study 1, five of whom scored 1.5 standard deviations or more above the mean K-MPAI score and three of whom scored 1.5 standard deviations or more below the mean K-MPAI score. Participants were interviewed about experiences of parenting during childhood and adolescence, along with their experiences of MPA and musical training. Interpretative phenomenological analysis was used to explore themes in the interview data. Study 1 factor analysis revealed four higher-order EMS factors, $F_{(4, 95)} = 13.74, p < 0.001$, one of which was a significant predictor of MPA, $t_{(99)} = 3.06, p = 0.003$. This factor comprised themes of failure, catastrophising, and incompetence/dependence. Study 2 qualitative analysis revealed various key parenting themes experienced in childhood that differentiated low- and high-MPA scorers in adulthood. Findings from both studies are discussed in light of clinical applications and interventions, and implications for both parents and music educators.
