

Abstracts from the Literature

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Zarate JM, Wood S, Zatorre RJ: Neural networks involved in voluntary and involuntary vocal pitch regulation in experienced singers. *Neuropsychologia* 2010;48:607–618.

In an fMRI experiment, experienced singers were tested with singing tasks to investigate neural correlates of voluntary and involuntary vocal pitch regulation. Investigators shifted the pitch of auditory feedback by either 25 cents (1/8 tone) or 200 cents (1 full tone), and singers either (1) ignored the shift and maintained their vocal pitch or (2) changed their vocal pitch to compensate for the tone shift. Investigators hypothesized that singers would be less able to ignore the 25-cent shifts due to a prepotent, corrective pitch-shift response. They also expected that voluntary vocal regulation during compensate tasks would recruit the anterior portion of the brain's rostral cingulate zone (RCZa) and posterior superior temporal sulcus (pSTS) and predicted that a different neural network may be engaged during responses to the small shifts. Indeed, singers were less able to ignore 25-cent shifts than 200-cent shifts, suggesting that pitch-shift responses to small shifts are under less voluntary control than responses to larger shifts. There was no neural activity specifically associated with involuntary pitch-shift responses. Compensate tasks recruited a functionally connected network consisting of the anterior portion of the RCZa, pSTS, and anterior insula. Analysis suggests that

pSTS and intraparietal sulcus may monitor auditory feedback to extract pitch-shift direction in 200-cent tasks but not in 25-cent tasks; this in turn suggests that larger vocal corrections are under cortical control.

Zarate JM, Delhommeau K, Wood S, Zatorre RJ: Vocal accuracy and neural plasticity following micromelody-discrimination training. *PLoS ONE* 2010; 5(6):e11181.

To determine the relationship between auditory discrimination skills and vocal accuracy, the authors administered an auditory-discrimination training program to 20 collegiate non-musicians. They wished to determine whether training-enhanced auditory discrimination would result in improved vocal accuracy. The program included micromelodies (melodies with seven different interval scales, each smaller than a semitone) as the main stimuli for auditory discrimination training and testing, and single-note and melodic singing tasks to assess vocal accuracy in experimental and control cohorts. To determine if improved vocal accuracy would be accompanied by related modulations in cortical activity during singing, the test group also performed the functional singing tasks while undergoing fMRI. Following training, this group exhibited significant enhancements in micromelody discrimination compared to controls. However, there was no correlated improvement in vocal accuracy during single-note or melodic singing, and the authors did not detect any training-induced changes in activity within brain regions associated with singing. They concluded that perceptual discrimination training alone is not sufficient to improve vocal accuracy in nonmusicians; this finding supports

the suggested association between auditory perception and vocal production.

Sammler D, Baird A, Valabrègue R, et al: The relationship of lyrics and tunes in the processing of unfamiliar songs: a functional magnetic resonance adaptation study. *J Neurosci* 2010;30(10): 3572–3578.

The cognitive relationship between song lyrics and tunes remains under debate; some researchers feel that lyrics and tunes are represented as separate components, while others argue that they are processed in an integrated fashion. This study used an fMRI adaptation paradigm during passive listening to unfamiliar songs. The repetition and variation of lyrics and/or tunes in blocks of six songs were crossed in a 2×2 factorial design to induce selective adaptation for each component. Decreased hemodynamic response on fMRI was observed along the superior temporal sulcus and gyrus (STS/STG) bilaterally. The left mid-STS showed an interaction of the adaptation effects for lyrics and tunes, suggesting an integrated processing of these two components at prelexical, phonemic processing levels. The degree of integration lessened toward more anterior regions of the left STS, where decreased interaction and greater adaptation for lyrics than for tunes suggested an independent processing of lyrics. Evidence for an integrated representation of lyrics and tunes was found in the left dorsal precentral gyrus (PrCG), possibly relating to the build-up of a vocal code for singing in which music and linguistic features are fused. Overall, the results demonstrate that lyrics and tunes are processed at varying degrees of integration and separation along an anatomic and functional gradient located in the anteroposterior axis of the left STS and the left PrCG.

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Epstein DM, Rose DJ, Philoppon MJ: Arthroscopic management of recurrent low-energy anterior hip dislocation in a dancer. *Am J Sports Med* 2010; 38(6):1250–1254.

Anterior hip dislocations are relatively rare injuries (~9% of all traumatic hip dislocations) and are historically associated with high-energy external forces delivered to the hip joint by mechanisms such as motor vehicle accidents, falls, and contact sports. The literature contains only one report of a low-energy anterior hip dislocation; this occurred in a dancer and was treated with open reduction. This report details a second such case, also in a dancer. The 22-year-old female had generalized ligamentous laxity, and the mechanism was one of flexion and external rotation. She underwent a successful closed reduction, but later MRI evaluation revealed an anterior labral tear and tears of the pectineus and obturator externus muscles. Despite proper protection and physical therapy rehabilitation, she suffered three additional dislocations over the following 6 to 8 mos, all related to dancing. Arthroscopic evaluation and treatment performed 9 mos after the initial dislocation consisted of debriding a severely torn acetabular labrum and ligamentum teres, debridement and partial release of the torn psoas tendon, and plication of the severely redundant anterior hip capsule. Following 6 mos of additional therapy, the patient returned to her prior level of professional jazz dance, with no further subluxations or dislocations reported thereafter. X-rays revealed no evidence of osteoarthritis or osteonecrosis.

Charbonnier C, Magnenat-Thalmann N, Becker CD, et al: An integrated platform for hip joint osteoarthritis analysis: design, implementation and results. *Int J CARS* 2010;5:351–358.

Ballet dancers are a risk group for developing osteoarthritis (OA) of the hip. The authors have developed a software program designed to improve understanding of hip OA using 3D anatomical models, MRI studies, and motion capture. The program provides

a dynamic assessment of the hip joint, including its kinematics, active range of motion, congruency and center of hip joint rotation, and detection and location of femoroacetabular impingement (FAI) regions. All these measurements cannot be performed clinically, and thus the software is designed to complement a standard static clinical evaluation. The software is driven by a medical ontology that takes into account not only the anatomy but also the functionalities of the musculoskeletal system. Thirty professional ballet dancers formed the test population for an *in vivo* assessment of the software; 10 of them were motion-captured while performing six dancing movements: *grand pli  , d  velopp      la seconde, d  velopp   devant, grand   cart lat  ral, grand   cart facial, and arabesque*. Results show that extremes of flexion, abduction, and rotation expose the morphologically “normal” dancer’s hip to recurrent superior or posterior FAI and to joint subluxation. Since most chondrolabral changes and FAI from cam or pincer movements are generally located in the anterosuperior region, the authors feel that dancing implies a new range of FAI due to extreme movements. The frequency of FAI and subluxation and the amount of penetration depth and femoroacetabular translations varied with the type of movement. The new software includes all the required materials and knowledge to improve orthopaedists’ performance in hip joint OA analysis.

Sartin JS: Contagious rhythm: infectious diseases of 20th century composers. *Clin Med Res* 2010;8(2)2: 106–113.

The medical histories of famous musicians/composers have long been fodder for scrutiny and discussion, with the unorthodox nature of the artistic life often the focus. Infectious diseases have led to illness and death for many famous musicians, from the classical period (Beethoven, Chopin) through the Romantic period (Donizetti, Schubert, Smetana) to the rock-n-roll era (Steven Tyler, Natalie Cole). Again and again, as new musical

forms have been developed, innovative artists have pursued atypical lifestyles that put them at risk for lethal pathogens. This was not true of all composers, however; Haydn, Bach, Brahms, and Wagner lived relatively long and productive lives mostly free of disease until their later years. By the 20th century, as public health improved and orchestral composers began living more settled and traditional lives, infections among American and European musicians became less frequent. Nearly half of contemporary post-romantic/modern composers died from the effects of cardiovascular disease or stroke (Dvorak, Grieg, Prokofiev, Copland). However, by mid-century, pioneering jazz musicians famously pursued lifestyles characterized by drug and alcohol abuse (Bix Beiderbecke, Louis Armstrong, Tommy Dorsey, Charlie Parker). Among the consequences of these lifestyles were tuberculosis, syphilis (Scott Joplin), and chronic viral hepatitis. More contemporary musicians have experienced an epidemic of hepatitis C infection (John Coltrane, Gerry Mulligan, Ray Charles) and HIV/AIDS related to promiscuity and intravenous drug abuse (Liberace, Freddy Mercury). Musical innovation is thus often accompanied by diseases of neglect and overindulgence, particularly infectious diseases, although risky behavior and its resultant infectious diseases tend to decrease as the style matures.

Pitman MJ: Singer’s dysphonia: etiology, treatment, and team management. *Mus Med* 2010;2(2):95–103.

Caring for a professional singer is a challenging and demanding task. Among the disorders they can develop is dysphonia, whose symptoms may range from a mild breathiness or vocal fatigue to severe hoarseness. Nearly all professional singers have experienced, or will experience, this problem during their careers. Medical practitioners should strive to recognize the disparate etiologies of dysphonia, diagnose them correctly, and treat them effectively and efficiently as the professional voice user requires. The singer’s responsibility is

to learn how to care for his/her vocal instrument and recognize dysphonia early, so it can be treated easily before a severe problem arises. This paper addresses these issues thoroughly, beginning with a clear description of vocal fold anatomy, followed by an excellent presentation of singing physiology and a discussion of the common causes of dysphonia. Basic sections on vocal fold pathology and diagnostic methods follow, finishing with conservative and surgical treatment options for the various disorders. The need for a team of professionals to meet the singer's needs is emphasized, as is the need for each of them to be aware of the role of others on the team. The goal is to create a collective understanding about dysphonia in singers so that the singer, physician, laryngologist, voice therapist, vocal teacher, and other caregivers can coordinate as a team to provide the best care and achieve the best possible result.

Montello L: The Performance Wellness Seminar: an integrative music therapy approach to preventing performance-related disorders in college-age musicians. *Mus Med* 2010;2(2):109–116.

College-age musicians and music students develop a variety of performance-related medical disorders; several recent studies describe the prevalence rates in the United States. These disorders include overuse-related conditions,

chronic pain syndromes, debilitating stage fright or performance anxiety, depression, and substance abuse. This article addresses many of the causes and contributing factors in the development of performance-related problems and offers a clinically tested curriculum (the Performance Wellness Seminar) for prevention, treatment, and empowerment. The integrated curriculum draws from clinically proven techniques from the disciplines of music therapy, behavioral medicine, and yoga science. This training offers participants a deeper understanding of the implications of stress in performance, as well as practical tools for allowing the body to become a resilient “instrument” in the face of stressful situations. The result is to increase confidence and reduce denial and self-destructive behaviors in college-age music students. Components of the curriculum include breath awareness, relaxation techniques, cognitive restructuring, mindfulness meditation, imagery training, music therapy for musicians, musical self-statements and charades, group music improvisation, and working to disarm the “inner critic” through combined art and music therapy processes. Assertiveness training and behavioral rehearsal also aid in improving performance quality. The author also includes Performance Wellness training recommendations for educators, counselors, and health professionals who work with college-age music students.

Thomas K, McCann PD: Shoulder pain in musicians. *Mus Med* 2010;2(2):89–93.

The orthopaedic literature contains relatively little about the care of musicians with shoulder pain and other performance-related musculoskeletal disorders. Musicians who routinely use their hands above shoulder level to play, such as upper string players and conductors (also percussionists, organists, and harpists—*Ed.*) are at risk for rotator cuff disorders. These range in degree from acute tendinitis to chronic tendinosis and tears of the rotator cuff muscles and tendons. The rotator cuff functions to stabilize the humeral head in the glenoid fossa and assists in arm elevation and rotation. Rotator cuff disorders usually produce pain and may result in weakness and difficulty in performing both everyday and musical activities. Treatment of these disorders focuses on conservative modalities such as rest, medication, and physical therapy, but surgical intervention (by both arthroscopic and open approaches) may be indicated for persistent pain or obvious structural disruptions. The authors stress physician awareness of these problems, as well as skill in diagnosis to ensure timely and appropriate treatment. (This reviewer was disappointed to read only about rotator cuff problems, when the title implies a wider range of disorders; specifically, a discussion of conditions such as bicipital tendinitis and rupture, osteoarthritis of the acromioclavicular joint, and a variety of bursal inflammations would have made this a much more complete and useful paper for the clinician.—*Ed.*)