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Abstract

Musician's Focal Dystonia is a task-specific neurological movement disorder affecting the fine motor control of 1-2% of highly skilled musicians, often disrupting or even terminating professional musical careers. Given that recovery from the condition is time-consuming and not at all guaranteed, prevention is of high importance.

The disorder develops as a result of a period of maladaptive learning, prompted and aggravated by a complex set of risk factors. While some of these, such as genetic predisposition, are immutable, others, such as practice organisation and strategies, general performance-related health, and psychosocial factors within the learning environment, are malleable and can be positively influenced in educational settings. This implies that music educators can play a significant role in protecting future generations from acquiring Musician's Focal Dystonia.

Therefore, this article aims to provide music educators with clear information about the pathophysiology of the condition, the potential risk factors, and guidelines for practical preventative steps which can be implemented in individual and group instrumental teaching. We hope that this work is the start of collaborative work between clinicians, health

professionals, music educators and the musicians themselves to work towards the common goal of reducing the cases of this disorder.

Keywords: Musician's Focal Dystonia, risk factors, preventative strategies, music education, musicians' health

I. Introduction

Musician's Focal Dystonia (MFD) is a task-specific neurological movement disorder that impairs highly skilled musicians' performance-related fine motor control (Altenmüller & Jabusch, 2009; Sadnicka et al., 2018). Between 1% and 2 % of professional musicians are affected (Altenmüller, 2003; Conti et al., 2008); thus, the condition affects thousands of accomplished musicians worldwide annually (Schmidt et al., 2013).

The symptoms are the deterioration of voluntary control of skilled movement patterns when playing a musical instrument. The beginning of the disorder frequently manifests in subtle loss of control in fast passages, finger-curling or involuntary finger extension, lack of precision in forked fingerings in woodwind players, irregularity of trills, fingers sticking on the keys, involuntary flexion of the bowing thumb in strings, and impairment of control of the embouchure in woodwind and brass players in certain registers and performing particular articulations (Altenmüller & Jabusch, 2009; Furuya et al., 2015; Mantel et al., 2023).

In the beginning, the symptoms are usually not linked to pain, although a subjective feeling of "tenseness" in muscles or joints may occur. Further, it is at inception mostly restricted to instrumental playing (Hofmann et al., 2015); however, it may transfer to other skilled movements in a later stage of the disorder (Rosset-Llobet et al., 2007). Since the diagnosis of

MFD may be perceived as traumatising, subtle first signs of the insidious beginning are termed “Dynamic Stereotype”, emphasising the potentially reversible nature of the disorder, especially at the first stages of the development (Altenmüller et al. 2015).

MFD has been described for almost every instrument, including keyboard, strings, plucked instruments, woodwind, brass, percussion, and folk instruments, such as bagpipes and accordion. In the to-date largest study (Altenmüller et al., 2012) of the epidemiology of 369 German professional musicians suffering from MFD, keyboard players were most common, with 27.1 %, followed by woodwinds (21.7%) and brass players (20.9 %). Compared to the overall population of musicians, brass players and woodwind players were over-represented among the patients (20.9% affected vs. 10% healthy musicians in brass, 21.7% vs 15% in woodwinds), and pianists and string players were slightly underrepresented. With respect to single instruments, in Doll-Lee et al.’s (2024) sample, the instrumentalists most commonly affected were pianists (22% of dystonia patients), guitarists (15.2%), flautists (9.7%), and violinists (7.6%). The mean age of inception of MFD depends on the instruments. Whereas in brass musicians it is around 40 years of age, in other instrumentalist it is about 35 years. The age when the individual begins intensive practice also plays a role: late starters have a higher risk of developing MFD (Schmidt et al. 2013).

Pathophysiology, treatment and risk factors

When loss of task-specific fine control motor control appears, the conclusion might be quickly reached that the musician is affected by MFD; however, conditions like nerve-compression syndromes, neurodegenerative diseases like Parkinson’s or Multiple Sclerosis, stroke, muscular disorders, and anxiety disorders may result in dystonic movements, especially in the first stages of the disorders. Therefore, the diagnosis of MFD requires a medical examination from a musician’s medical expert to rule out underlying disorders as the

source of the symptoms and ideally identify the condition as “idiopathic” MFD, meaning that there are no other underlying neurological or psychiatric diseases. “Idiopathic” MFD, with an estimated 90% of the cases, is by far the most common condition, resulting from a combination of underlying genetic predisposition and long- or short-term triggering factors, which we will elaborate on in the article. In the following, we will focus on this form of the disorder and use the term MFD to describe this idiopathic condition.

Musician’s Focal Dystonia is a “network disorder” of the brain (Alpheis et al., 2023; Doll-Lee et al., 2023; Sadnicka et al., 2023); sensorimotor control of highly skilled movements and their expressive qualities is based on a subtle interplay of many brain areas which are connected via a dense web of neurons and regulated via inhibition or excitation of certain pathways of these networks. This subtle interplay results from life-long learning and is accompanied by adaptations in brain structure and function, named cerebral plasticity. An imbalance of this interplay of inhibition and excitation can result in overactivity of neurons addressing muscular tone and thus lead to dysfunctional movement patterns and reactive compensatory movements, frequently in distant muscle groups. For example, dystonic stiffening of the wrist muscles may have, as a consequence, increased tension or even elevation of the shoulder. Under certain triggering conditions, these dysfunctional movement patterns are stabilised in long-term motor (“muscle-)” memory and manifest as dystonia. In other words, MFD is a “learned” disease, and its pathophysiology is fortunately not linked to the degeneration of nerve cells or nerve fibres but to dysfunctional “maladaptive” changes in the firing patterns of neurons. The good news is that such a learned disease can also be unlearned. (For a review of the pathophysiology of MFD, see Altenmüller & Furuya, 2016).

Treatment of MFD is still challenging; however, considerable progress has been made in the last ten years. Given an early diagnosis, probably the most successful treatment method is

retraining, a behavioural method combining reorganisation of movement patterns by slow movement, body awareness, general relaxation, guidance of focus of attention, and psychotherapy (e.g., de Lisle et al., 2012; Détári, 2023; van Vugt et al., 2014). Symptomatic treatment of the overactive muscles through temporary weakening by injecting Botulinum-toxin has proven to be helpful in other cases (Frucht et al. 2024); however, since the injections need to be applied regularly every three to five months, and long-term use can lead to muscle atrophy (Salari et al., 2018), this approach does not offer a good solution for young patients. Various medications, such as muscular relaxants or antidepressants, may alleviate symptoms and improve motivation (Jabusch et al. 2005). Novel strategies with brain stimulation aim to reverse maladaptive plastic changes, for example, with inhibition of over-active motor areas on the affected side, alongside activation of the contralateral "healthy" motor cortex, whilst musicians perform in-phase symmetrical finger exercises on a keyboard (Furuya et al., 2015). These methods yield mixed results: only a small percentage of musicians respond positively to the treatment (see Ampomah et al., 2025, under review).

Prevention

Since the outcomes of treatment are still frequently unsatisfying, the challenge is to prevent musicians from acquiring the disorder. While a recent paper convincingly demonstrates that the frequency of MFD cases in Germany has remarkably declined since 2013 by 40% (Worlitzsch et al., 2025, under review), there is a notable absence of recommendations for prevention in the literature, and subsequently, very little systematic and documented action has been taken specifically to reduce the number of MFD cases. This might stem from the primary research focus on non-malleable factors, such as genetic predisposition (Schmidt et al., 2009) and gender (Doll-Lee et al., 2024). However, the task-specific nature of the condition, i.e., the fact that in most cases, the disorder, at least in the beginning, exclusively affects movements associated with playing an instrument (Hofmann et al., 2015), suggests

that participation in music-making in educational and professional musical settings contributes to its development. Therefore, it would be logical to implement preventative strategies in the same context. Furthermore, researchers began to venture outside the boundaries of the previously established medical models (Alpheis et al., 2022; Alpheis et al., 2024; Enders et al., 2011; Schneider et al., 2021), including examining these unique learning and working environments (Détári, 2022; Détári et al., 2022; Détári & Egermann, 2022a; Détári & Egermann, 2022b). These explorations highlighted a broad range of potential psychosocial and behavioural triggering factors arising in these settings. It has been suggested that the characteristics of the learning experience, such as the atmosphere in the classroom and pedagogical approaches (Détári et al., 2022), the relationship between the ability of the musician and the task requirements (Sadnicka et al., 2018), practice strategies (Détári, 2022; Jabusch & Altenmüller, 2006), and the efficiency and biomechanical quality of the instrumental technique (Détári et al., 2022; Sadnicka et al., 2018) might contribute to the onset of the disorder. Notably, these factors are malleable and could be tackled while learning and performing professionally. Thus, these recent research findings open up the possibility of developing preventative strategies.

While the research around various malleable risk factors is in its initial stages, there is some evidence that musicians are more likely to develop dystonia when they have:

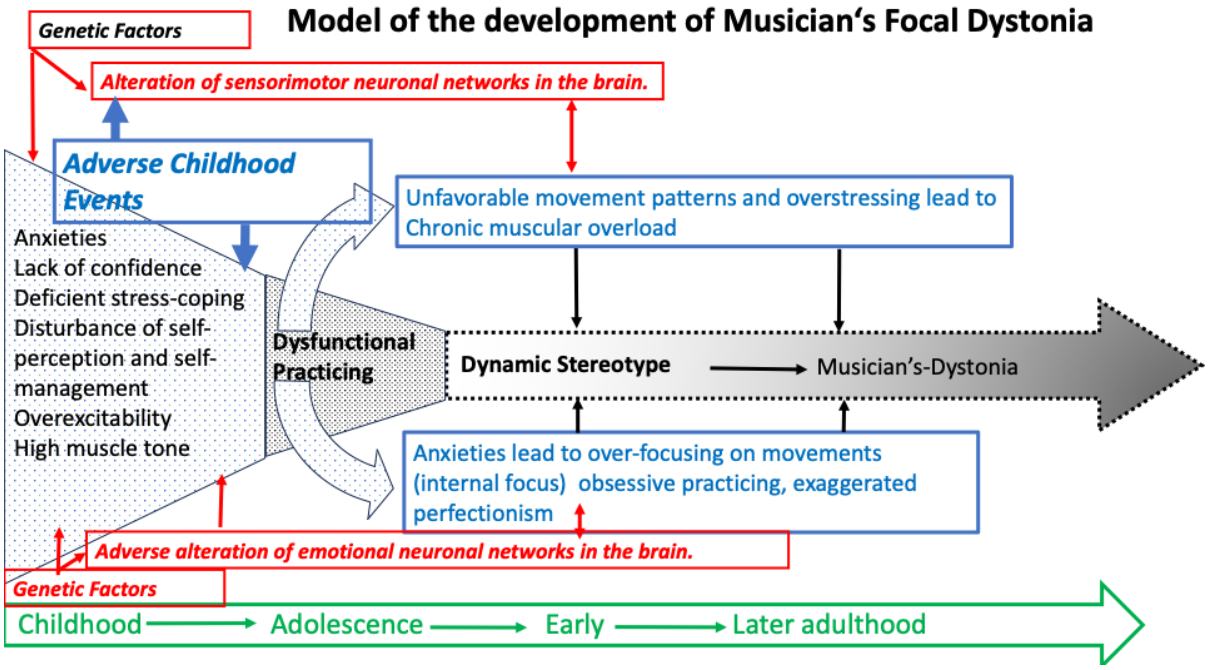
1.) High workload at the instrument combined with other fine motor burdens, e.g. writing (Baur et al., 2011)
2.) Unfavourable practice methods, such as excessive practice without breaks and lack of planning, too repetitive practice strategies, too much dependency on internal focus of attention, and ineffective and incorrect biomechanics (Détári et al., 2022a; Passarotto et al., 2024)
3.) Chronic pain (Altenmüller and Jabusch, 2010)

4.) General psychological stressors, such as maladaptive perfectionism, anxiety, and phobias (Enders et al., 2011; Jabusch et al., 2004)
5.) Specific psychological stressors related to learning and playing the instrument, such as socially prescribed perfectionism, authoritative and controlling teaching styles, low levels of psychological safety, and abuse (Détári, 2022; Détári et al., 2022)

Additionally, musicians who later acquire MFD seem to experience more adverse childhood events (Alpheis et al., 2022). Alpheis et al. (2023) hypothesised that the resulting increased stress reactivity and dysfunctional stress regulation stemming from the early maladaptation plays a crucial role in the development of the disorder. Also, musicians with MFD tend to start their training later than their peers (Schmidt et al. 2013). Given that the Central Nervous System's adaptability starts to decline slowly with the ageing process, late starters might develop less efficient and more fragile neural structures supporting the complex movements necessary for playing an instrument (Altenmüller et al., 2014).

In alignment with our operational definition of MFD as a "learned" disorder, our thoughts on tackling the triggering factors will be arranged roughly in chronological order to demonstrate the developmental trajectory of the condition in an individual musician's life.
It has to be noted, however, that both malleable and non-malleable contributing factors might greatly influence and even aggravate each other, creating a complex system with substantial variation between cases; therefore, this proposed trajectory remains hypothetical. In Figure. 1, we have summarised this trajectory.

Figure 1.



Note. Heuristic model of the putative development of Musician's Focal Dystonia in a time perspective from birth to adulthood, based on Altenmüller et al. (2014, p. 171) On the left, genetic and early life factors, possibly contributing to the development of Musician's Focal Dystonia, are depicted. During adolescence, dysfunctional practice attitudes and teaching methods may contribute additionally. Other factors can further contribute.

Musician's Focal Dystonia, until recently, has primarily been discussed after the fact, mostly in the offices of medical professionals. Now, however, with the help of the newly developing holistic understanding, we have an opportunity to start thinking about preventative strategies. Considering the developmental trajectory of the condition and the nature of some of the risk factors, musicians and music educators need to be part of this conversation. This article aims to start the process of establishing a knowledge exchange between all interested parties to develop actionable steps that can be implemented across all music-making activities and to foster collaboration and informed decision-making. To reach this goal, we discuss potential contributing factors and offer advice on prevention, referring to various concepts and

practices for musicians and music educators to implement in their teaching and practice.

II. Preventing Musician's Dystonia: what music educators can contribute.

As demonstrated by the previous section, Musician's Focal Dystonia is likely to be the "end product" of a longer period of psychological and behavioural deterioration, aggravated by psychosocial factors rather than a sudden, unexplained illness syndrome. In other words, it might be the result of cumulative stress associated with both performance-related risk factors and psychosocial influences and "only after a combination of 'hits' will dystonia start to develop" (Sadnicka et al., 2016, p. 3). Thus, the accumulating maladaptive contributing factors might increase without detection, resulting in the perception of the onset as a sudden and unexplained event. In Figure 1, we attempted to visualise the interplay between genetic and contributing factors and their dependency in a simplified manner. With this understanding of the complex interrelationship between factors, we have means at hand to possibly prevent the development of dysfunctional playing habits (potentially resulting in MFD) through education and healthy practice.

Adverse Childhood Events

Although music educators cannot directly influence family life and adverse childhood events like prolonged hospitalisation of the child, divorce, psychiatric illness of caregivers or emotional or physical abuse, they can be resources for their students' emotional well-being (Jiang, 2024). Learning environment matters, and positive, encouraging feedback, clear communication of the expectations, and room for mistakes can have a significant positive impact on the learner's motivation (Dweck & Masters, 2012; O'Neill, 2011), self-efficacy (Patston & Waters, 2015), and motor behaviour (Wulf, 2013; Wulf & Lewthwaite, 2016).

Late start

Here, systemic approaches are needed, and a music educator can only marginally influence the child's and parents' decision to start playing an instrument. Generally, family, peer group, and societal factors, such as the socioeconomic status of parents and cultural identity, are important factors influencing the choice to learn to play an instrument (Martin, 2008). General advice is to generate a climate of joyful music-making by increased visibility (and audibility) of musical activities of children and adolescents in a community. If a child is interested in learning an instrument, it is important to respect the choice of sound since innate auditory preferences for high- or low-pitched instruments may influence the child's decision (Schneider et al., 2023). Generally, an early start with any instrument is beneficial since, according to the above-mentioned laws of metaplasticity, an auditory-sensory-motor integration network is established, which probably transfers to other instruments (Tierney & Kraus, 2014).

When, however, a child starts learning relatively late compared to their peers, it is crucial to consciously and systematically establish the technical foundations of their selected instrument and monitor how the technical demands of the played material compare to their skillset and their physical and mental development. Additionally, clear communication about the necessity of this process might be advisable to reduce any perceived pressure regarding their development.

Teaching, feedback-, learning-, and practicing-habits to prevent MFD

Supportive Learning Environment

The core expertise music educators can contribute to the prevention of MFD is creating a supportive and psychologically safe learning environment. Learning and teaching are inherently social endeavours (Gruhn, 2004), thus, the content of education cannot be separated from the way it is conveyed. The atmosphere of the lessons can carry similarly meaningful messages as the delivered information itself and needs to be consciously constructed, just like the taught materials. While the topic of psychological safety is largely discussed in relation to psychological and mental states (Edmondson & Lei, 2014), it also might have a profound effect on movement acquisition and performance. Thus, practising in unsafe and stressful environments can lead to the automatisation of overly tense and maladaptive movement patterns, which might lead to dysfunction. As Wulf and Lewthwaite (2016) put it, basic psychological needs, such as the need for safety, must be met, or at least not threatened, to achieve optimal motor learning. Therefore, an appreciative teaching atmosphere, mindfulness, adaptation to the student's learning progress, and a sensitive feedback technique are the keys to success here. Avoidance of dysfunctional perfectionist behaviours, individualised practice strategies (McPherson et al., 2019) including flexible focus of attention, and inclusion of mental practice seem to be beneficial (Connolly & Williamon, 2004). While there are excellent articles available on healthy practice strategies (e.g., McPherson et al., 2019), more experimental research is needed on the topic, especially considering the effects of various strategies on performance.

Adequate Feedback

Several studies have demonstrated that positive feedback directly influences motor behaviour and plays a significant role in enhancing the motor learning process (Avila et al., 2012;

Badami et al., 2011; Chiviacowsky et al., 2012; Palmer et al., 2016; Wulf & Lewthwaite, 2016). The findings of these studies indicate that positive social-comparative feedback, which includes praising individuals in comparison to their peers to highlight their superiority, and positive normative feedback, which emphasizes development beyond the actual performance quality, enhance self-efficacy (Avila et al., 2012; Lewthwaite & Wulf, 2012).

However, it is important to note that an ideal learning environment does not solely consist of constant positive feedback without constructive criticism. Correcting mistakes and providing suggestions for improvement are crucial elements in music education (McPherson et al., 2022); in fact, instrumental teachers tend to provide more negative feedback compared to classroom teachers (Duke & Henninger, 1998). Nevertheless, the delivery and tone of such criticisms significantly influence how feedback is received and implemented. In a recent innovative study (McPherson et al., 2022), a comprehensive framework has been proposed for delivering feedback, consisting of three distinct levels: feedback, feed-up, and feed-forward. This framework aims to facilitate skill development by incorporating a reflective analysis of previous performance, comparing the learner's current performance to a desired future state, and focusing on the student's developmental trajectory. By employing feedback from these three levels in a balanced manner, students can gain insights into their skill development process, engage in reflective practice, and establish both short-term and long-term goals.

Additionally, McPherson et al. (2022) highlight the differentiation between task-level, process-level, and self-regulation feedback. While task-level feedback, which involves error correction, is commonly used in music education, it may not be the most effective form of feedback. On the other hand, both process-level and self-regulatory feedback encourage

students to acquire strategies for self-monitoring and self-correction, offering additional advantages in terms of individualised practice.

Avoidance of dysfunctional perfectionism

Enns et al. (2002) provided a useful definition of the differences between adaptive and maladaptive perfectionism: “Adaptive perfectionism involves the setting of high goals and personal standards and striving for the rewards associated with achievement while retaining the ability to be satisfied with one’s performance. In contrast, maladaptive perfectionism is characterised by the setting of inflexible and/or unattainably high standards, the inability to take pleasure in one’s performance and uncertainty or anxiety about one’s capabilities”. There is a close association between perfectionism and anxiety (Alpheis et al., 2024; Lunn et al., 2023); especially, socially prescribed perfectionism correlates positively with anxiety and depression, while self-oriented perfectionism shows no association with depression and correlates positively only with positive affect (Lunn et al., 2023).

Perfectionism often begins in early childhood when a child is confronted with high performance standards, as often is the case when a child learns an instrument (Domocus & Damian, 2018). Research further suggests that perfectionism is transgenerationally passed on from parents to their children (Appleton et al., 2010). In music specifically, when parents are aiming at a professional career for their offspring, it is necessary to start intensive practising early on: many children have accumulated between 15,000 and 18,000 practice hours when they reach the age of eighteen (Ericsson et al., 1994). These kinds of demands in early childhood in performance-oriented families can promote the development of perfectionistic behaviour. As music teachers, perfectionist behaviours in students can be prevented by avoiding a rigid system of criticism and high pressure from competition during musical

education (Vervainioti & Alexopoulos, 2015); moreover, a supportive relationship with the teacher can serve as a protective factor against maladaptive perfectionism (Domocus & Damian, 2018). These practices can also help prevent fatigue, depression, and performance anxiety (Jeong & Ryan, 2022).

Autonomous, competent, and self-efficient learning style

Instrumental playing, especially classical music, is typically taught via the master-apprentice model (Haddon, 2009; Hyry-Beihammner, 2010; Jørgensen, 2000), which implies that the tutor is the bearer of objective and indisputable knowledge which is communicated via demonstrations and verbally with statements and closed questions, and the student is responsible for incorporating the information in their playing. The method is dictated by tradition, which is passed down from generation to generation unchallenged, and it is thought to guarantee high artistic standards (Duffy, 2013). These ideas, however, have been challenged on many fronts: psychologists claim that one of the cornerstones of motivation is autonomy (Ryan & Deci, 2000), music educators and researchers promote a more constructivist and self-directed approach to learning (Carey et al., 2017; Duke, 2012; Jørgensen, 2000; McPhail, 2013; McPherson & Hattie, 2022), and sports psychologists began to explore how exercising agency can positively change the motor output (Katz & Westera, 2019; Wulf et al., 2014, Wulf & Lewthwaite, 2016).

The ability to exercise agency over one's circumstances and behaviours is not only a deep-seated psychological need (Ryan & Deci, 2000) but also a "biological necessity" (Wulf & Lewthwaite, 2016, p. 1392) driven by a survival instinct (Leotti et al., 2010). Thus, reducing an individual's choices can have profoundly negative psychological effects, such as impaired emotional regulation, increased stress responses, and learned helplessness; furthermore, it can

undermine feelings of competence and self-efficacy (Leotti et al., 2010). Apart from the psychological effects, being denied agency can have a significant negative impact on motor output as well. It has been shown in a series of sports psychology studies (Hartman, 2007; Katz & Westera, 2019; Sanli et al., 2013; Wulf et al., 2014) that giving choices about the practice conditions enhances and accelerates the learning process, even if the choice is about insignificant details of task (Wulf et al., 2014).

In the music education literature, we find similar arguments for implementing a more constructivist way of teaching, i.e., encouraging the learner to be an active participant in their learning rather than a passive receiver of the knowledge presented by the teacher (Burwell, 2017; Carey et al., 2017; Duke, 2012). Furthering this point, Jørgensen (2000) points out that fostering individuality and self-directed learning in music students supports their individual practice, which potentially contributes more to their development than the limited time spent on the lessons.

The choices can be made about what and how is being practised (e.g., selection of repertoire and constructing one's practice strategies), but decisions about the interpretation and artistic matters are equally important. These initiatives are often suppressed by the teachers (Jørgensen, 2000; Rostvall & West, 2003) due to the prescriptive nature of the genre and socio-cultural factors, such as the teaching traditions and the "pressure to conform", which is "inherent in the musical and cultural society" (Jørgensen, 2000, p. 70). While some higher educational institutions began to challenge traditional teaching ideologies, it is still not the norm to encourage students to develop their individual musical identity (Almqvist & Werner, 2024), therefore it is important to maintain an open conversation about the topic.

There are various ways to enhance student autonomy in instrumental lessons; autonomy-supporting language (the frequent use of open questioning to allow the students to reach their own conclusions) is one of the most important elements of a constructivist framework (Duke, 2012; Paul & Elder, 2007). Giving students space to think about their choices enhances competence and self-efficacy and potentially leads to a more self-directed and efficient individual practice (Carey et al., 2017; Jørgensen, 2000). Engagement with this teaching style, however, needs to be cultivated (Burwell, 2017). Teachers who are used to teaching in a more authoritative manner, replicating their own education (Burwell, 2017; Duke, 2012; Visentin et al., 2008) and students who are not used to making their own choices both need to consciously implement the approach into the process.

Supporting stress management and health awareness in students

As presented in the sections about contributing factors, lack of positive health-related behaviours, inefficient instrumental technique, physical performance-related injuries and associated pain syndromes can provoke the onset of MFD (Altenmüller et al., 2014). Therefore, health awareness and maintaining one's general health, in addition to the development of an efficient, biomechanically correct instrumental technique, are key elements of MFD prevention. To ensure this, it is crucial that the setup of the instrument is appropriate for the learner's physical characteristics, for example, selecting an optimally sized instrument or adjusting seating height and distance for a keyboard player.

In terms of general and performance-related health, the high number of performance-related injuries, such as musculoskeletal disorders (Kok et al., 2016), has already prompted some health-promoting initiatives, especially within higher educational institutions (Chesky et al., 2006; Rosset et al., 2022; Zander et al., 2010). While these various programs and health

provisions put in place are surely supportive, a recent study still shows that 65% of music students studying at conservatoires in Europe have experienced painful musculoskeletal problems (Cruder et al., 2020). Additionally, very little health support is available for music hubs and independent studios to promote healthy playing for beginners and younger students (Norton, 2016).

Instrumental teachers can make a substantial difference in their studios and classrooms by promoting healthy performance-related behaviours, changing the statistics one person at a time. As Norton (2016) explains, teachers' health-promoting behaviours can depend on various factors, such as personal experiences with performance-related injuries, but the majority are interested in advocating a healthy lifestyle for their students. To ensure that following this trend, efficient communication of health-related information to music students takes place in the classroom, we argue that teachers should have access to evidence-based information and be familiar with available support networks within and outside their institution. Furthermore, proper advice concerning playing techniques is an important part of the professional qualifications of teachers. Informed teachers can contribute to beneficial practice schedules, including sufficient pauses, flexible and adaptive postures with sufficient micro-mobility, and a healthy instrumental technique adapted to the student's needs and physical characteristics.

Summary

For the sake of simplicity and clarity, we presented the topics in this section separately; however, in truth, they seem to be deeply interconnected. For example, authoritative teaching methods combined with the lack of psychological safety in the classroom might stop a student from signalling their problems promptly and attempt to complete tasks which are

beyond their physical capabilities. This might lead to excessive and unnecessary muscular tension and a compromised instrumental technique, which can lead to maladaptive learning and further performance-related technical issues. Then, due to the perceived or real expectations driven by unhealthy perfectionism, the student might engage in further excessive practice, ingraining unhealthy movement behaviours and cognitive strategies. For a young, predisposed music student who potentially has high stress-reactivity and feels pressured to catch up with their peers, this learning trajectory might lead to the development of serious performance-related issues, including MFD.

Practical Conclusions

In order to decrease the cases of Musician's Focal Dystonia in the musician population, we need to make prevention our top priority. This, however, cannot be achieved from the offices of medical professionals alone: musicians and music educators need to be informed, and they need to contribute their expertise to the discourse and implement preventative educational and pedagogical strategies in their practice. Real change can only be initiated in the music classrooms and practice rooms, educational institutions and organisations, spearheaded by the musicians themselves.

To achieve this goal, we need to establish reciprocal communication. Music educators and musicians need detailed and accurate information about the disorder, while researchers and medical professionals should engage more with the developmental trajectory of MFD rather than just the outcome. Further, detailed exploration and more empirical data would be necessary to understand how each of the suggested risk factors influence individual musicians, and how already available pedagogical strategies can help prevention.

Additionally, the shared effort could also benefit from instrument-specific knowledge provided by musicians.

These communications could happen via written materials, such as this initial article, but also through direct communication with educational institutions and think tanks and workshops with educators. We suggest that the conversations should start by discussing potential psychosocial and biomechanical risk factors for developing MFD and strategies for reducing them. These include establishing the necessary technical foundations, especially in late starters, constructivist teaching methods, student autonomy in the classroom, productive feedback, teaching effective practice strategies, health literacy, and stress management. By connecting the specialist knowledge of music educators and musicians with the latest scientific findings of psychology, biomechanics, and neuroscience, we could potentially reduce the prevalence of MFD and support the next generation of musicians to fulfil their potential.

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