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An overview of rehabilitation approaches for focal hand dystonia in musicians: A scoping review

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Abstract

Objective: To provide a comprehensive overview of rehabilitation treatment strategies for focal hand dystonia (FHD) in musicians, examining their evolution and effectiveness.

Data Sources: A systematic search of five databases, PubMed, PEDro, Cochrane Library, Trip, and Google Scholar, to identify relevant articles on FHD rehabilitation. The last search was performed on 20 December 2023.

Methods: Inclusion criteria were applied to 190 initially identified articles, resulting in 17 articles for review. Exclusions were made for duplicates, irrelevant titles, abstracts, and non-rehabilitation interventions.

Results: Ten different rehabilitation approaches were identified over 20 years. While no definitive intervention protocol exists, a multimodal approach is commonly recommended.

Conclusions: This scoping review underscores the diversity of rehabilitation strategies for FHD. It suggests the potential of multimodal approaches, emphasizing the need for further large-scale clinical efficacy studies.

Keywords

Musician's dystonia, rehabilitation, motor retraining, task-specific training

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Introduction

Focal hand dystonia (FHD) in musicians also known as musician's focal dystonia or musician's cramp is a task-specific movement disorder characterized by involuntary loss of control and coordination of finger movements during instrument playing. It is generally painless and associated with extensive and vigorous use of the fingers. The etiology of FHD in musicians is still considered idiopathic but is likely multifactorial.[1–3] The co-contraction of agonist and antagonist hand muscles in affected musicians is associated with inadequate reorganization of cortical finger representation areas and reduced sensory perception, resulting in temporal-spatial discrimination anomalies. It can develop in musicians with genetic predisposition, alterations in the basal ganglia circuit, or after prolonged and repetitive instrument practice, possibly associated with psychological factors such as anxiety disorders, perfectionism, and stress.[4–6] Currently, the prevalence of dystonia in musicians is estimated to be 0.2–0.5%, with guitarists, pianists, and wind instrument players being the most commonly affected, accounting for 70% of patients. The onset of dysfunction rarely occurs during the initial development of instrumental technique but typically emerges after years of instrument practice when the musician is at the peak of their career. Affected musicians experience a sudden or insidious deterioration of their sensorimotor abilities, reporting a lack of coordination during performance often accompanied by involuntary flexion or extension of the fingers during musical passages that require rapid movements and control. Symptoms include cramping sensation, abnormal posture of the affected hand, finger curvature, and loss of coordination during specific activities.[7] The loss of coordination is characterized by involuntary flexion of dystonic fingers or extension of adjacent fingers to compensate for abnormal movement, along with prolonged co-contraction of flexor and extensor muscles.[8–11] This disorder most commonly affects fingers 3, 4, and 5 of the hand. FHD in musicians is a highly disabling condition, often impacting musicians' careers. Multiple strategies have been explored to manage dystonia in musicians, with highly variable results. The currently available data do not provide guidance for choosing a rehabilitative intervention plan. The objective of this scoping review is to present a map of the current treatment strategies and their temporal evolution, examining how rehabilitation approaches have adapted over time to integrate into increasingly effective therapeutic contexts.

Methods

The present scoping review was conducted following the JBI methodology[12] for scoping reviews. The preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR)[13] checklist for reporting was used. Research team: To support robust and clinically relevant results, the research team included authors with expertise in evidence synthesis, quantitative and qualitative research methodology, sport and musculoskeletal rehabilitation, experts in rehabilitation of the hand. Review question: We formulated the following research question: "What are the rehabilitation strategies and their temporal evolution for FHD in musicians, and how have they been integrated into increasingly effective therapeutic management contexts?". Eligibility criteria: Studies were eligible for inclusion if they met the following population, concept, and context (PCC) criteria.
Population:

- Studies involving musicians diagnosed with FHD.
- Studies focusing on musicians from various instrument groups.

Concept:

- Studies investigating rehabilitation strategies or interventions for FHD in musicians in musicians.
- Studies exploring the effectiveness, outcomes, or impacts of rehabilitation approaches.
- Studies describing the evolution or changes in rehabilitation strategies over time.

Context:

- Studies conducted in any geographical location.

- Studies published in peer-reviewed journals.
- Studies published in the English language.
- Studies with available full-text articles.

Exclusion criteria: Studies that did not meet the specific PCC criteria were excluded. Search strategy: The following electronic databases were utilized: PubMed, PEDro, Cochrane Library, Trip, and Google Scholar. Additional studies were identified through bibliographic references and related articles. Contact was made with authors via email to identify additional sources and gain access to full-text articles if not readily available. In addition, gray literature (e.g. Google Scholar, direct contacts with experts in the field) and reference lists of all relevant studies were also searched. Searches were conducted on 20 December 2023 with no date limitation. The summary of these articles is presented in Table 1. The article selection process is depicted in a flow chart (Figure 1). The entire selection process and reasons for the exclusion were recorded and reported according to the latest published version of the PRISMA 2020 flow diagram. Data extraction and data synthesis: Data extraction was conducted using an ad-hoc data extraction form which was developed a priori, based on the JBI data extraction tool. Key information (authors, country, year of publication, study design, patients characteristics, PFD, type of intervention, and related procedures) on the selected articles were collected. Studies identified and included were reported as frequency and percentage, and the description of the search decision process was mapped. In addition, extracted data were summarized in tabular form according to the main characteristics.

Results

As presented in the PRISMA 2020-flow diagram (Figure 1), from 190 records identified by the initial literature searches, 173 were excluded and 14 articles were included (Table 1). Study selection: A total of 190 articles were identified through the search of the aforementioned electronic databases. These articles were initially screened based on their titles and abstracts, resulting in the exclusion of 172 articles that did not meet the eligibility criteria or were duplicates. The remaining 18 articles underwent a full-text review, during which four articles were excluded for the following reasons: the study population did not consist of musicians or the intervention was not relevant to rehabilitation. After this process, 11 articles were deemed eligible for inclusion. Additionally, three articles were obtained through manual searching of related articles and contacting the authors for additional information, bringing the total number of included articles to 14 in this review. The summary of the combined results from these 14 studies explored various treatment techniques for FHD in musicians, focusing on motor and sensory recovery. Most showed improvements in motor control and reduction of dystonia symptoms. Techniques ranged from sensorimotor rehabilitation and orthosis use to mirror therapy and memory-based training. These personalized approaches suggest potential in reorganizing sensorimotor neural networks and enhancing musical performance.

The studies explored various rehabilitative approaches for musicians with FHD. They include sensory-motor retuning (SMR), which was effective for pianists and guitarists, and a combined constraint-induced therapy and motor control retraining approach, showing significant long-term improvements. Sensory discrimination training focused on sensory tasks, enhancing motor control. Learning-based sensorimotor and memory training (LBSMT) documented improvements in specific task performance. Instrumental retraining adapted to different instruments showed promising outcomes. Sensory-motor rehabilitation therapy indicated gradual improvements. Kinesiotaping didn't show significant benefits, while the Alexander technique seemed effective for guitarists. MusAARP and modified graded motor imagery showed overall positive results in improving hand movements and posture. Each study presented a unique approach to managing FHD, highlighting the complexity and diversity of treatment methods.

Discussion

The diverse rehabilitative approaches for FHD in musicians indicate a preference for multimodal

Table 1. Main characteristics of included studies.

Authors / title	Year study type population	Intervention	Outcome
Victor Candia et al.[14] "Sensory Motor Retuning: A Behavioral Treatment for Focal Hand Dystonia of Pianists and Guitarists"	2002 Case Series 11 Musicians (6 Pianists, 2 Guitarists, 3 Wind Players)	Sensory Motor Retuning Dystonia Evaluation Scale <1.8 (Severe to Mild Dystonia) Pianists and Guitarists: Dystonia Evaluation Scale >2.5 to 3.8; Wind Players: DES 0.8 to 1.9 (Similar to Pre-Treatment)	Pianists and Guitarists: Dystonia Evaluation Scale 2.4 to 3.9; Wind Players: Dystonia Evaluation Scale <1.4 (Similar to Pre-Treatment), No Benefit for Wind Players
Nancy N. Byl et al.[15] "Effect of Sensory Discrimination Training on Structure and Function in Patients With Focal Hand Dystonia: A Case Series"	2003 Case Series 3 Wind Musicians	Sensory Discrimination Training	Significant improvements in somatosensory evoked potentials (>86.8%), hand representation area (increased over 20%), response amplitude (improved by 40%), sensory discrimination (>22%), musculoskeletal performance (>31.9%), and fine motor control (average improvement 23.9%). Two out of three musicians returned to their musical careers.
Rae de Lisle et al.[16] "Pianism Retraining: A Case Series"	2006 Case Series 3 Pianists	Pianism Retraining	Scale for Quality of Effort: Improvement in non-dystonic hand from 3.12 to 3.78 points, dystonic hand from 2.32 to 3.54 points. Difficulty in Hand Instrumental Exercise: Significant decrease in correct identification of dystonic hand by blind listeners from pre-treatment (79%) to post-treatment (28%). TRE test: Increase from pre to post-treatment of 1.0 points on average, with variations among subjects. VER test: Overall increase of 1.3 points, with individual improvements detailed.
Katherine Butler et al.[17] "Focal Hand Dystonia Affecting Musicians. Part II: An Overview Of Current Rehabilitative Treatment Techniques"	2006 Descriptive Study Musicians with Focal Hand Dystonia	Overview of Rehabilitation Interventions	Identified three main categories of rehabilitation approaches: 1) Multidisciplinary approach including sensory and motor treatments, rest from triggering activities, and occupational therapy. 2) Use of orthoses. 3)

(Continued)

Table 1. (Continued)

Authors / title	Year study type population	Intervention	Outcome
			Supportive therapeutic approaches such as instrument modifications, Feldenkrais and Alexander techniques, biofeedback therapy, psychotherapy, and prevention through organized practice and rest schedules. Future research areas in focal hand dystonia highlighted.
Nancy N. Byl et al.[18] "Focal Hand Dystonia: Effectiveness of a Home Program of Fitness and Learning-based Sensorimotor and Memory Training"	2008 Case Series 13 subjects with Focal Hand Dystonia, including 7 musicians	Learning-based Sensorimotor and Memory Training	Improvements in spatial and sensory discrimination (88%), target-specific performance (75%), and motor speed (76.5%). Functional independence, fine motor skills, and hand strength did not show statistically significant scores. Six months post-treatment: Most subjects returned to work, with functional independence scores equivalent to healthy controls for most participants.
Rae de Lisle et al.[19] "Pianism Retraining via Video Conferencing: A Case Report"	2009 Case Report 1 Pianist	Pianism Retraining via Video Conferencing	Scale for Quality of Effort: Improvement in non-dystonic hand by 0.20 points (95% CI [-0.9, 0.49], $p = 0.17$) and dystonic hand by 0.68 points (95% CI [0.23, 1.13], $p = 0.0037$) during in-person training; similar improvements in video conferencing. Difficulty in Hand Instrumental Exercise: Identification of dystonic hand decreased significantly post-treatment in both in-person (from 95% to 44%) and video conferencing (to 62%) settings.
Patrice Berque et al.[3] "A Combination of Constraint-induced Therapy and Motor Control Retraining in the Treatment of Focal Hand Dystonia in Musicians"	2010 Case Series 8 Musicians (6 professionals, 2 non-professionals)	Combination of Constraint-induced Therapy and Motor Control Retraining	Significant decrease in abnormal movements over 12 months ($F = 6.32$, $p < 0.001$). Improvements noted in Toronto Western Spasmodic Torticollis Rating Scale ($F = 4.96$, $p < 0.001$) and Arm Dystonia Disability Scale ($F = 3.60$, $p = 0.004$). Increased performance speed noted in

(Continued)

Table 1. (Continued)

Authors / title	Year study type population	Intervention	Outcome
			the first 6 months, with variations in later months.
Rae de Lisle et al.[20] "Rehabilitation of a cellist whose vibrato was affected by focal dystonia"	2012 Case Report 1 Cellist	Instrumental Retraining	Dystonia Evaluation Rating: Improved from 1 (worst dystonia) pre-treatment to 2 (slightly improved) post-treatment, and 4 (almost normal) at follow-up. Variable for Control of Response: Improved from 1 pre-treatment to 2 post-treatment (irregular sound on long notes), and 3 at follow-up (controlled sound on long notes at steady speed). Violoncellist's Questionnaire Evaluation: Improved from 1.14 (SD 0.52) pre-treatment to 2.82 (SD 0.86) post-treatment, with sustained improvement to an average score of 2.75 (SD 0.89, $p < 0.0001$) at follow-up.
Patrice Berque et al.[3] "A Combination of Constraint-Induced Therapy and Motor Control Retraining in the Treatment of Focal Hand Dystonia in Musicians A Long-term Follow-up Study"	2013 Case Series, Long-term Follow-up Study 4 Musicians Classical	Combination of Constraint-Induced Therapy and Motor Control Retraining	Frequency of Abnormal Movements: 80% reduction in abnormal movements over time for both combined pieces ($F = 7.85$, $df = 8$, $p < 0.001$). Toronto Clinical Scoring System: No statistically significant changes between 12 months and 4 years (p values ranging from <0.001 to 0.043). Arm Dystonia Disability Scale: No statistically significant changes between 12 months and 4 years (p values ranging from <0.001 to 0.045). Metronome speed achieved by subjects without abnormal movements increased over time from about 30–100bpm for both pieces ($F = 20.45$, $df = 8$, $p < 0.001$), with consistent improvement over time except in year 4 for the medium difficulty piece.
Katherine Butler et al.[21] "Sensory–motor rehabilitation therapy for task-specific focal hand dystonia: A feasibility study"	2018 Randomized Controlled Trial 15 subjects: 8 musicians	Sensory-motor rehabilitation therapy	Improvement in scores at 3 and 6 months compared to baseline: Arm Dystonia Disability Scale (0–100% scale, higher scores indicate less disability) improved

(Continued)

Table 1. (Continued)

Authors / title	Year study type population	Intervention	Outcome
	with Musician's Dystonia, 7 with Writer's Dystonia		from 66.07 to 70.0 (3 months) and 69.25 (6 months); Toronto Western Spasmodic Torticollis Rating Scale (0–5 scale, higher scores indicate less disability) improved from 2.86 to 3.0 (3 months) and 3.43 (6 months); Brief Illness Perception Questionnaire (0–80 scale, 80 indicates the most threatening disease perception) improved from 50.67 to 47.25 (3 months) and 44.33 (6 months); EQ-5D 5L (0–1 scale, 1 indicates full health) improved from 0.79 to 0.84 (3 months) and 0.88 (6 months); Video (1–4 scale, 4 indicates greater impairment) improved from 2.5 to 1.68 (6 months); Clinical Global Impression Scale, 0–7, 7 indicates much worse) improved from 3.08 (3 months) to 2.58 (6 months). Qualitative interviews indicated effectiveness percentages for Sensory-motor reprogramming (86%), Slow-down exercise (71%), Mirror Therapy (43%), Shoulder and hand exercises (43%), while soft tissue massage and ultrasound were not effective.
Riccardo Bravi et al.[22] "Assessment of the effects of Kinesiotaping on musical motor performance in musicians suffering from focal hand dystonia a pilot"	2019 Pilot Study 7 musicians	Kinesiotaping	Experts reported no significant differences in effects between corrective Kinesiotaping and Sham for both criteria: "General Performance" and "Fingers Posture". Musicians self-assessed that Kinesiotaping was ineffective in improving general performance. Some subjects reported improved fine control during performance, which might be attributed to the "sensory trick" phenomenon.
Marina Ramella, et al.[23] "Modified Graded Motor Imagery for Musicians' Focal Dystonia"	2021 Case Series 6 musicians	Modified Graded Motor Imagery	Results showed improvements in Toronto Western Spasmodic Torticollis Rating Scale ($z = 2.449$, $p < 0.05$) and Arm

(Continued)

Table 1. (Continued)

Authors / title	Year study type population	Intervention	Outcome
			Dystonia Disability Scale ($z = 2.000$, $p < 0.05$), but not in Dystonia Evaluation Scale ($z = 1.414$, $p > 0.05$). At the end of treatment, musicians evaluated their overall performances, selected pieces, and a C major scale as improved: Global Performance Score ($z = 2{,}214$, $p < 0.05$), Piece Performance Score ($z = 2{,}207$, $p < 0.05$), Scale Performance Score ($z = 2{,}207$, $p < 0.05$).
Bronwen Ackermann et al.[24] "MusAARP: Pilot Study"	2021 Pilot Study 4 musicians	MusAARP: Anatomy-based Retraining Program	Tubiana rating scale scores improved for all participants. Participant 1: Pre-treatment score 3, post-treatment score 5 (returned to concert repertoire). Participant 2: Pre-treatment score 3, post-treatment score 5 (resumed playing and preparing for exams). Participant 3: Pre-treatment score 3, post-treatment score 4 (took a break at six months due to breath-holding during practice, then continued with meditation and online retraining). Participant 4: Pre-treatment score 2, post-treatment score 5 (playing returned to normal).
G. Mohan Kumar et al.[25] "Impact of Alexander technique mirror therapy versus conventional therapy on musician's cramp in guitarists"	2022 Comparative study 150 musicians	Alexander Technique, Mirror Therapy, Conventional Therapy	Likert Scale Pre-test Scores: Group A - 38.86, Group B - 38.92, Group C - 38.78 (no significant difference pre-test among groups). Post-test Scores: Group A - 22.76, Group B - 32.62, Group C - 28.32 (significant differences post-test among groups, $p \leq 0.001$).

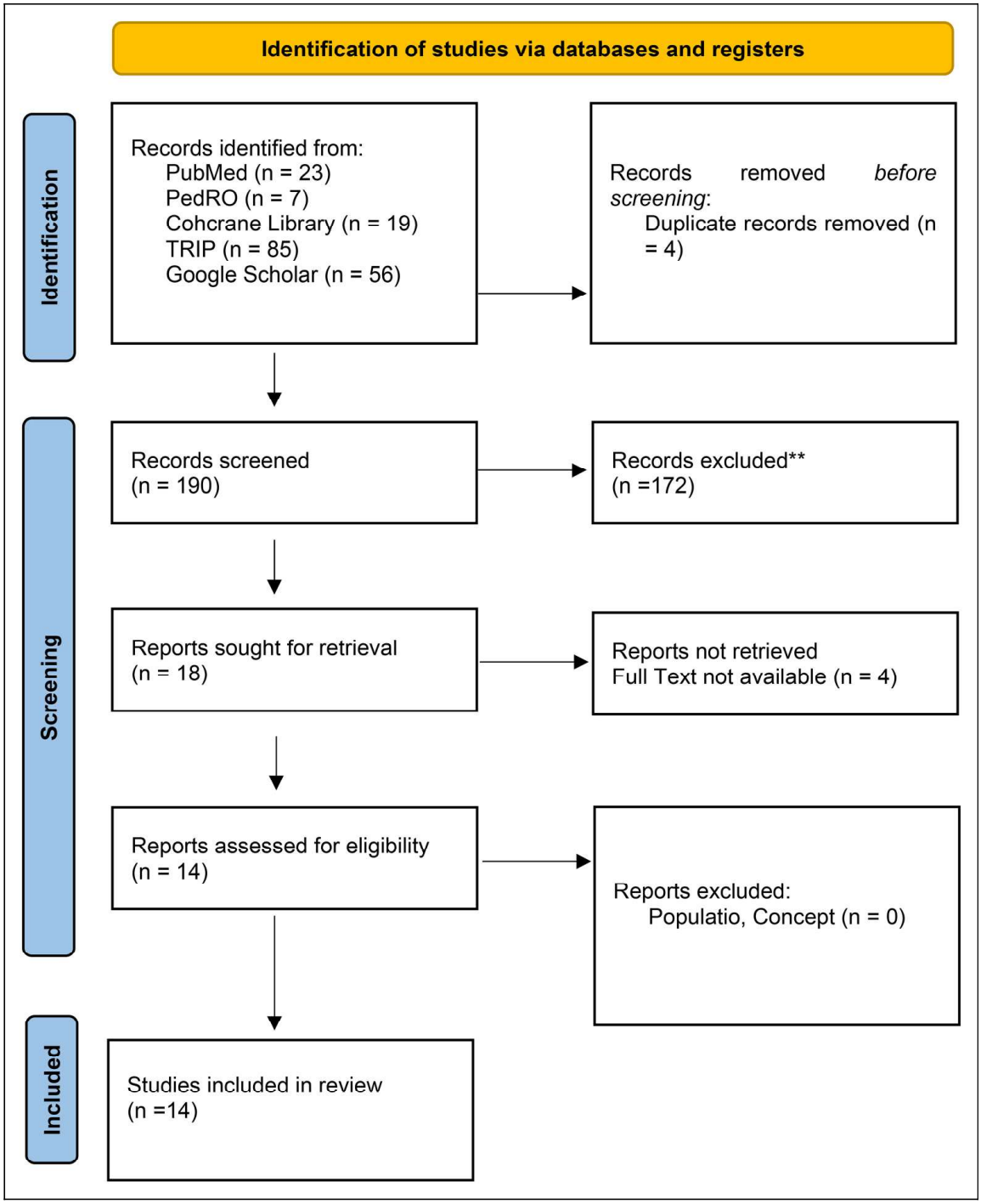

Figure 1. Preferred reporting items for systematic reviews and meta-analyses 2020 (PRISMA) flow diagram.

intervention. SMR has shown effectiveness for pianists and guitarists but not for wind instrument musicians. The integration of SMR with slow-down exercise (SDE) addressed this limitation, showing improvement in wind musicians when combined with instrument playing. Sensory discrimination training and LBSMT have also contributed valuable insights. The use of orthoses in methods like sensory-motor rehabilitation therapy and modified graded motor imagery (mGMI)

raises questions about its applicability based on dystonia severity. Instrumental retraining by Rae De Lisle, although requiring musical knowledge, bridges the gap between rehabilitation and music. The ineffectiveness of Kinesiotaping in reducing dystonic patterns, despite some subjective improvements, suggests a "sensory trick" phenomenon. The Alexander technique, compared to mirror therapy and conventional therapy, showed improvements in guitarists. Collaboration between therapists and instrument teachers could enhance preventive aspects of FHD management. The literature suggests multimodal rehabilitation is preferable for treating FHD in musicians. Studies highlight the effectiveness of SMR for pianists and guitarists, but less so for wind musicians. Combining SMR with SDE improved outcomes for wind musicians, potentially due to the integration of instrument playing in exercises. The use of orthoses in newer therapies like sensory-motor rehabilitation therapy and mGMI raises questions about its suitability based on dystonia severity. Rae De Lisle's instrumental retraining suggests the need for therapy approaches bridging rehabilitation and music. Bravi et al.'s study on Kinesiotaping showed limited effectiveness. The Alexander technique outperformed mirror therapy and conventional therapy in guitarists. Overall, recent studies incline towards multimodal approaches, with promising results in varied therapies like mGMI and MusAARP. However, further research is needed to refine these approaches, considering the high expectations of affected musicians and the diversity of methodologies in existing studies. The comprehensive literature review on FHD in musicians provides an evidence-based, holistic approach to understanding the condition. It includes various studies, suggesting a need for individualized treatment, interdisciplinary collaboration, and preventive education. However, it lacks detailed implementation strategies, may not generalize across all clinical settings due to varying patient characteristics, and is limited by knowledge as of September 2021. Crucially, the absence of randomized controlled trials is a significant gap, hindering the development of definitive treatment guidelines and underscoring the need for high-quality research in this area. In clinical practice for managing FHD in musicians, it's important to conduct comprehensive assessments, adopt a multidisciplinary approach, and create individualized treatment plans. Rehabilitation interventions should incorporate evidence-based practices like sensory-motor retraining and motor imagery. Education on self-management, regular monitoring, and collaboration with music educators are crucial. Continuous professional development is also key to stay informed on the latest research and treatment advancements in FHD. In conclusion, FHD necessitates a multidisciplinary approach for effective management. Individualized treatment plans tailored to the patient's needs are essential. Rehabilitation interventions, including sensory-motor retraining and feedback techniques, show promise in FHD in musicians. Patient education and self-management strategies play a crucial role in long-term success. Regular monitoring and collaboration with music educators can enhance outcomes. Continuous professional development is vital for staying updated in FHD in musicians' management.

Clinical message

- For treating FHD in musicians, a multimodal rehabilitative intervention is recommended, combining various therapeutic approaches to achieve better results.
- Rehabilitation strategies should be tailored to individual needs, considering the severity and specific characteristics of the dystonia in each musician.
- Emerging treatments and collaborative efforts between rehabilitation experts and music educators can enhance therapy effectiveness and facilitate a smoother return to performance.

Authors' note

Pasquale Arcuri is also affiliated with Studio Fairplay - Arcuri Functional Rehabilitation of the Upper Extremity, Private Practice, Bologna, Italy.

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