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The Role of Electrical Stimulation and Exercise in Managing Flexible Flatfoot: A Narrative Review.

Nouran Mohamed Mohamed Ahmed Adam[1*], Hesham Ezzat[2], Haitham Mohamed[3], Amr Aboelfadl[4]

1. Demonstrator, Department of Basic Sciences, Faculty of Physical Therapy, Badr University, Assiut, Egypt
2. Vice Dean for Postgraduate Studies and Research Affairs Faculty of Physical Therapy Deraya University .
3. Lecturer of Basic Science Faculty of Physical Therapy Deraya University
4. Lecturer of Orthopedic Faculty of medicine Assiut University.

Abstract:

Flexible flatfoot, or pes planus, is a common postural deformity characterized by the collapse of the medial longitudinal arch during weight-bearing, which may lead to discomfort and altered biomechanics. It frequently presents in children and may persist into adulthood, potentially causing pain, fatigue, and gait abnormalities. Conservative management is typically the first line of treatment, with physical therapy playing a pivotal role. This narrative review explores two primary conservative interventions—exercise and electrical stimulation and their combined role in managing flexible flatfoot.

Exercise-based interventions focus on strengthening the intrinsic and extrinsic muscles of the foot, particularly those involved in supporting the arch, such as the tibialis posterior. Targeted activities, including foot doming, toe curls, balance training, and stretching, have demonstrated effectiveness in improving dynamic stability and proprioception. These exercises not only enhance foot strength but also improve motor control and functional performance. On the other hand, electrical stimulation techniques especially neuromuscular electrical stimulation (NMES) and transcutaneous electrical nerve stimulation (TENS) offer adjunctive benefits by promoting muscle activation and modulating pain. NMES is particularly effective in eliciting controlled muscle contractions, which may further reinforce the arch and complement exercise outcomes. The integration of these two modalities offers a holistic, non-invasive treatment approach. By combining the benefits of both techniques, clinicians can optimize therapeutic outcomes and address the multifaceted nature of flexible flatfoot. This review consolidates current knowledge and highlights the synergistic potential of electrical stimulation and exercise as complementary strategies for effective flatfoot management.

Keywords: Flexible flatfoot, electrical stimulation, exercise therapy, foot arch support, conservative management.

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Introduction:

Flexible flatfoot, characterized by a pronounced arch that collapses underweight yet appears normal when weight is off the foot, presents a unique challenge in podiatric care. As a condition that predominantly affects children but can persist into adulthood, its management has garnered significant attention within clinical practices. The term 'flexible flatfoot' itself spans a continuum of severity, requiring a nuanced understanding of both its classification and the implications it holds for function and mobility. Physical therapy, particularly through targeted exercise and, more recently, electrical stimulation, has emerged as promising avenues for managing this condition[1].

Exercise regimens tailored to strengthen the intrinsic muscles of the foot have been shown to enhance arch support and alleviate discomfort, thereby improving overall gait mechanics. Meanwhile, electrical stimulation techniques have gained traction as adjunct treatments, promoting muscle activation and aiding rehabilitation efforts. This narrative review seeks to consolidate existing knowledge surrounding flexible flatfoot, emphasizing the crucial interplay between electrical stimulation and exercise in treatment protocols. By identifying key strategies, understanding patient needs, and examining emerging research directions, the review aims to equip clinicians with the insights necessary to enhance patient care outcomes in managing flexible flatfoot. In doing so, it endeavours to foster a holistic approach that integrates innovative treatment modalities while remaining grounded in the fundamentals of podiatric health[2].

Understanding Flexible Flatfoot:

Flexible flatfoot, also known as pes planus, is a condition characterized by a decreased arch in the foot that can be visually observed when the individual is standing, but typically appears normal when the foot is off the ground. This type of flatfoot is particularly common in children and often presents no symptoms or discomfort; however, it can lead to issues in adulthood, including pain in the arch or heel, and can affect the alignment of the lower limbs. The distinction between flexible and rigid flatfoot is essential, as flexible flatfoot can adapt and change with weight-bearing activities, whereas rigid flatfoot maintains its morphology regardless of position. Classifying flexible flatfoot can involve assessing various factors, including result from physical examination, patient history, and imaging studies such as X-rays or MRI, which can provide insight into the structural aspects of the foot. Epidemiological studies suggest that flexible flatfoot is prevalent among children, with studies indicating that up to 25% of children exhibit some degree of flatfoot, while prevalence may decrease as they grow older, typically resolving by around the age of six. In adults, however, the incidence of symptomatic flexible flatfoot may rise due to factors such as obesity, age, and lifestyle, putting additional strain on the supportive structures of the foot[3]. Understanding the pathophysiology behind flexible flatfoot reveals that it primarily stems from a combination of genetic predisposition and biomechanical abnormalities. These abnormalities can affect the tendons, ligaments, and muscles related to the foot's arch, leading to an increased load on the plantar fascia and associated structures. Notably, dysfunction in the posterior tibial tendon is often involved in cases of flexible flatfoot, where its inability to adequately support the arch contributes to its collapse during weight-bearing activities. This intricate relationship between anatomy, function, and potential symptomatic outcomes underscores the importance of a multidimensional approach in addressing flexible flatfoot and highlights the necessity for tailored intervention strategies[4].

The Role of Exercise:

Exercise plays a crucial role in the management of flexible flatfoot, providing an effective means to strengthen the muscles and tendons supporting the foot's arch, improve proprioception, and enhance overall functional mobility. A tailored exercise program can target the dynamic stability of the foot by focusing on specific muscle groups such as the tibialis posterior, which plays a critical role in maintaining the arch during weight-bearing activities. Exercises like foot doming, where the patient is instructed to lift the arch while keeping the toes and heel on the ground, or toe curls with marbles, not only strengthen intrinsic foot muscles but also promote motor control and coordination. Additionally, stretching exercises can help alleviate tension in the calf muscles, reducing the risk of compensatory patterns that may exacerbate flatfoot deformities[5]. Furthermore, engaging in low-impact aerobic exercises, such as swimming or cycling, can improve cardiovascular fitness without placing excessive strain on the feet. The integration of balance and proprioceptive training through activities like single-leg stands or the use of balance boards further assists in challenging the stability of the foot and ankle, crucial for those suffering from flexible flatfoot. The systematic incorporation of these varied forms of exercise creates a holistic approach that not only addresses the physical manifestations of flatfoot but also empowers patients through improved strength, flexibility, and overall foot health. Moreover, adherence to consistent exercise regimens can lead to better functional outcomes, reduced pain, and enhanced quality of life for individuals affected by this condition. On the whole, exercise serves as a cornerstone in the conservative management of flexible flatfoot, highlighting the importance of an active lifestyle and personalized exercise prescription tailored to each patient’s unique needs [6].

Electrical Stimulation Techniques:

Electrical stimulation techniques have gained popularity in the management of flexible flatfoot, offering an innovative approach to alleviate symptoms and promote foot function. These techniques primarily involve the application of electrical impulses through conductive pads placed on the skin, targeting muscles and nerves to create contractions or modulate pain perception. The mechanism of action is rooted in the stimulation of the neuromuscular system, which can enhance muscle strength, improve circulation, and accelerate the healing process[7]. Among the various forms of electrical stimulation, neuromuscular electrical stimulation (NMES) and transcutaneous electrical nerve stimulation (TENS) are the most commonly utilized. NMES, in particular, focuses on stimulating the motor nerves to invoke muscle contractions, thereby strengthening the intrinsic and extrinsic muscles of the foot and ankle. This is crucial for patients suffering from flexible flatfoot, as strengthening these muscles may support the arch and alleviate the symptoms associated with excessive pronation[8]. In contrast, TENS primarily targets sensory nerves to alleviate pain, providing immediate relief from discomfort that may accompany flatfoot conditions. The efficacy of electrical stimulation in managing flexible flatfoot has been variously reported, with some studies indicating significant improvements in muscle strength and foot function when used in conjunction with exercise regimens. In clinical settings, the integration of electrical stimulation techniques can enhance traditional therapeutic approaches, potentially leading to improved outcomes for patients seeking non-invasive management of flexible flatfoot[9].

Conclusion:

Flexible flatfoot can be effectively managed through a combination of exercise and electrical stimulation. These interventions improve foot strength, stability, and reduce discomfort. The integration of both modalities supports a comprehensive, individualized, and conservative treatment plan.

Recommendations and Future Directions:

Future studies should investigate the long-term effects and optimal protocols for combined interventions. Tailored, age-specific programs may enhance outcomes and should be a focus in clinical research.

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