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PHYSIOTHERAPY AND ORTHOTIC INTERVENTIONS FOR ENHANCING FUNCTIONAL MOBILITY AND MUSCLE STRENGTH IN LOWER LIMB DISORDERS: A REVIEW OF EVIDENCE FROM PAKISTAN

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Abstract

Lower limb disorders are a major contributor to functional disability, reduced mobility, and muscle weakness in Pakistan, necessitating effective rehabilitation strategies grounded in context-specific evidence. This review aimed to systematically evaluate the effectiveness of physiotherapy, orthotic, and combined rehabilitation interventions in improving functional mobility and muscle strength among individuals with lower limb disorders in Pakistan. A comprehensive literature search was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework across multiple electronic databases. Following screening, eligibility assessment, and methodological appraisal, 12 studies met the inclusion criteria and were retained for synthesis. For analytical clarity, the included studies were categorized into three groups: physiotherapy-based interventions, orthotic interventions, and combined or integrated rehabilitation approaches. Evidence from physiotherapy-focused studies demonstrated statistically significant improvements in pain, functional mobility, balance, and muscle strength, across outcome measures such as WOMAC, KOOS, Timed Up and Go, Gross Motor Function Measure, gait speed, and functional strength tests. Orthotic intervention studies reported improvements in gait alignment, joint loading, range of motion, and activities of daily living; however, outcomes were inconsistent, and several studies highlighted increased fatigue, comfort-related issues, or limited functional independence when orthoses were used without active rehabilitation. Studies examining combined rehabilitation approaches consistently reported superior outcomes, including greater gains in functional strength, mobility, and quality of life, compared with single-modality interventions. Collectively, the evidence indicates that physiotherapy constitutes the primary determinant of functional recovery, while

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orthotic devices are most effective when prescribed as adjuncts within comprehensive, multimodal rehabilitation programs tailored to the Pakistani healthcare context.

INTRODUCTION

Functional mobility refers to an individual's ability to move independently and safely in different environments, including standing, walking, transferring, and performing daily activities, while muscle strength represents the capacity of skeletal muscles to generate force necessary for movement and postural control. Both functional mobility and muscle strength are fundamental determinants of independence, quality of life, and participation in society, particularly in individuals affected by lower limb disorders. Conditions involving the lower limbs commonly lead to reduced strength, altered gait patterns, balance impairments, and activity limitations, making rehabilitation interventions essential for restoring function and preventing long-term disability (1).

In Pakistan the lower limb disorders burden is significant because it is a combination of the neurological, musculoskeletal, metabolic and trauma based. Lower limb impairment is often caused by stroke, cerebral palsy, post-polio residual paralysis, diabetic neuropathy, osteoarthritis, fractures and road traffic injuries, and it can be seen that often these causes are experienced in the most productive years of the individuals . Restricted access to early rehabilitation services, lateness in referrals and socioeconomic factors further exacerbate the functional implications of these conditions. This leads to an increase in the number of persons who endure disability, rely on others, and fail to engage in employment and community activities, which underscores the importance of effective rehabilitation initiatives in the local medical setting (2).

Physiotherapy and orthotic treatment are well-known as the elements of lower limb rehabilitation. Physiotherapy treatment including therapeutic exercise, gait training, balance retraining, and neuromuscular facilitation is designed to improve muscle strength, coordination, as well as functional mobility. Orthotic devices, such as ankle-foot orthoses, knee-ankle-foot orthoses, and custom foot orthoses, are designed to enhance alignment of the limbs, external support, efficiency of gait, and decrease compensatory movement patterns. In isolation or used in conjunction, these interventions can greatly enhance functional outcomes, but their efficacy depends on the characteristics of the patients, clinical skills, spread of resources, and context-specific factors to particular healthcare environments (3).

Although there is an increase in international literature to support the use of physiotherapy and orthotic management in lower limb disorders, the literature of Pakistan is still in bits. There is a great number of local studies, which are small-scale, with different methodological quality, or on isolated interventions without full examination of functional mobility and muscle strength outcomes. Moreover, differences in clinical practices, access to orthotic treatment, and rehabilitation facilities in urban and rural environments restrict the external validity of the evidence world-wide to the Pakistani community. This lack of consolidated, context-specific evidence creates challenges for clinicians, educators, and policymakers seeking to implement evidence-based rehabilitation strategies tailored to local needs (4).

Considering such gaps, it is obvious that there is a necessity to synthesize the current Pakistani evidence on the subject of physiotherapy and orthotic interventions to lower limb disorders. A targeted literature review can offer a perspective on the existing practices, reported results, and available limitations as well as outlining the areas in which the research and clinical advancement should be furthered. Thus, this review will analyze and summarize the existing evidence on the use of physiotherapy and orthotic due to lower limb disorders to help improve functional mobility and muscle strength in individuals (5). These goals will be to examine popular rehabilitation modalities, consider functional outcomes as reported, and point out challenges and subsequent directions of enhancing rehabilitation practice in Pakistani healthcare system.

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Methodology

Research Approach

The chosen review methodology was evidence-based qualitative research because the corresponding study needed to complete a systematic search and identification of the literature that reported lower limb disorder physiotherapy and orthotic interventions in Pakistani healthcare environment through the appraisal and synthesis of the evidence. The method was selected to enable the incorporation of different study designs to withstand methodological rigor and clinical rehabilitation practice.

Research Design

It was a narrative review design that is led by systematic principles. This design was taken as suitable because of the limited number of high quality research studies in Pakistan and because of the necessity to obtain a broader scope of the clinical evidence such as observational studies, quasi-experimental research and intervention based clinical reports in relation to the local rehabilitation environment.

Search Strategy and Data Sources

A comprehensive literature search was conducted across multiple electronic databases, including PubMed, Google Scholar, PakMediNet, and ScienceDirect. The search covered studies published between January 2005 and March 2025 to ensure inclusion of contemporary rehabilitation practices. Boolean operators were applied to enhance search precision using combinations such as: ("physiotherapy" OR "physical therapy") AND ("orthotic*" OR "ankle foot orthosis" OR "lower limb orthoses") AND ("functional mobility" OR "muscle strength" OR "gait") AND ("Pakistan"). Manual searching of reference lists from relevant articles was also performed to identify additional eligible studies not captured through database searches.

Inclusion and Exclusion Criteria

The studies were included in case they were carried out in Pakistan, they had human participants with neurological, musculoskeletal, or metabolic lower limb disorders, and the results were associated with functional mobility or muscle strength. This was the eligibility of the study designs which were interventioal studies, quasi-experimental studies, cohort studies and controlled clinical interventions. The articles were also interrogated based on the following criteria: those that were not undertaken in Pakistan, those that only dealt with upper limb rehabilitation, those that only dealt with surgical interventions, those that only dealt with pharmacological interventions without rehabilitation, lacked functional outcome measures and those that were opinion pieces, editorials, conference abstracts that did not provide full text or case reports without sufficient methodological description.

Study Selection Using PRISMA Framework

The identification, screening, eligibility assessment, and inclusion of the study were guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. Titles and abstracts were pre-screened and finally the full-text reviewed to ensure that they are eligible on pre-determined criteria.

Quality Appraisal and Data Management

The quality of included studies in terms of them being methodological was measured with the Critical Appraisal Skills Programme (CASP) checklists that corresponded to the design of a study. The extraction and quality appraisal of data were compiled systematically by means of Microsoft Excel, which made it possible to compare the data across the studies in a structured manner. Narrative synthesis was performed using Microsoft Word, whereas EndNote software helped with the management of references and consistency of cites.

Results

The objective of the review was to synthesize the existing evidence on the effectiveness of physiotherapy, orthotic and combined rehabilitation intervention in improving functional mobility and muscle strength in people with lower limb disorders with a specific interest in the studies that are applicable to the Pakistani healthcare setting. In order to do so, a systematic literature review was performed in line with the PRISMA framework.

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Following the initial search, all identified records were screened for relevance through title and abstract review, after which full-text articles were assessed against strict inclusion and exclusion criteria. Studies that did not report functional mobility or muscle strength outcomes, were conducted outside the scope of lower limb rehabilitation, or lacked sufficient methodological detail were excluded. After completion of the PRISMA-guided screening and eligibility process, a total of 12 studies met the inclusion criteria and were retained for final synthesis.

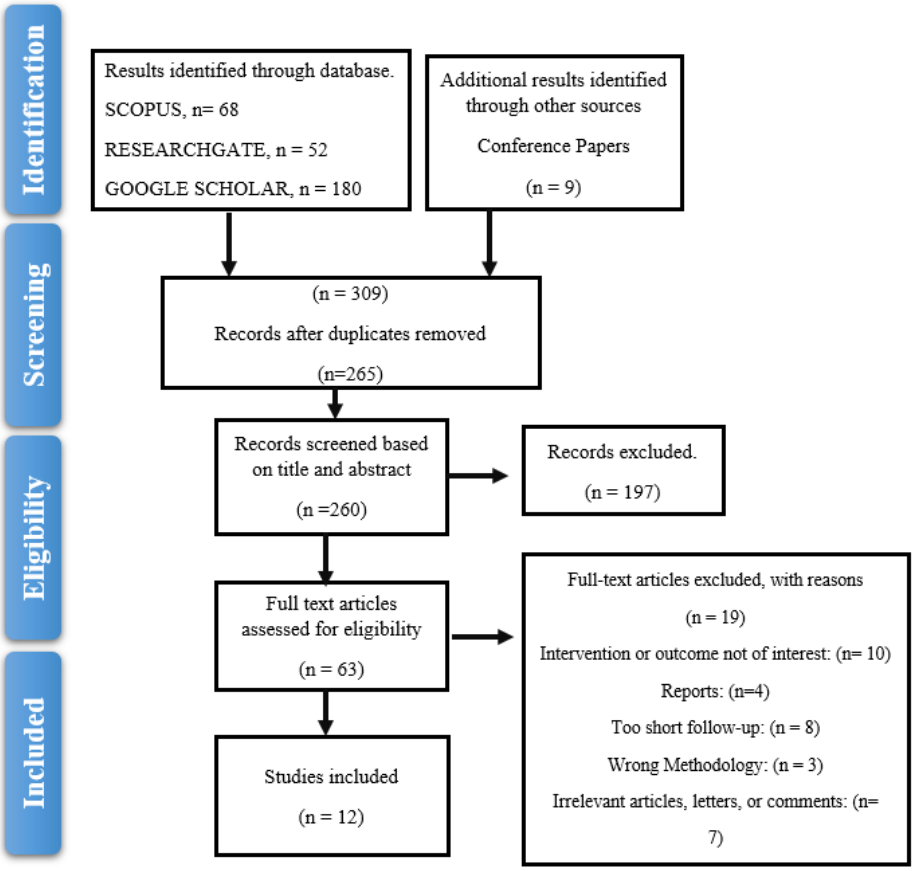

Figure 1: The PRISMA Framework

For clarity and ease of interpretation, the included studies were categorized into three main thematic groups: physiotherapy-based interventions, orthotic interventions, and combined or integrated rehabilitation approaches. This categorization facilitated a structured analysis of outcomes across different intervention strategies and enabled meaningful comparison of their effectiveness within the Pakistani context

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Table 1: Summary of Included Studies on Physiotherapy, Orthotic, and Combined Interventions for Lower Limb Disorders.

Author(s)	Study Title	Aim of the Study	Study Design	Key Outcomes
Rafiq et al. (2023)	Effects of Progressive Resistance Strength Training on Knee Osteoarthritis	To evaluate the effects of progressive resistance training on pain, mobility, and activities of daily living in knee osteoarthritis	Prospective interventional study	Significant improvements observed in WOMAC pain scores, Katz ADL scores, and Timed Up and Go performance following intervention
Mehwish et al. (2021)	Hip Joint Mobilisations and Strength Training in Knee Osteoarthritis	To assess the impact of hip joint mobilisations combined with strengthening exercises on pain, function, and balance	Prospective interventional study	Marked improvements noted in pain, physical function, and dynamic balance following intervention
Rehan et al.	Mulligan Mobilization versus Strengthening Exercises in Pelvic Girdle Pain	To examine the effects of mobilization, strengthening, and combined physiotherapy approaches in pelvic girdle pain	Interventional clinical study	Combined physiotherapy approach demonstrated the greatest reductions in pain and disability with improved quality of life
Iftikhar et al. (2021)	Supported Standing with Functional Electrical Stimulation in Acute Stroke	To determine the effects of supported standing combined with functional electrical stimulation on strength and mobility	Interventional clinical study	Substantial improvements reported in balance, functional mobility, and lower limb strength
Afzal et al.	Functional Strength Training in Hemiplegic Cerebral Palsy	To explore the effects of additional functional strength training on mobility in children with hemiplegic cerebral palsy	Experimental interventional study	Significant gains observed in gross motor function and functional strength outcomes
Mannan et al. (2020)	Universal Exercise Unit Training in Cerebral Palsy	To examine the effects of functional strength training on lower limb spasticity	Quasi-experimental interventional study	Spasticity levels reduced from 3.4 ± 0.5 to 1.46 ± 0.99 following intervention
Anees et al.	Physiotherapy Interventions in Children with Erb's Palsy	To evaluate the effects of physiotherapy on strength, range of motion, and functional performance	Clinical interventional study	Notable improvements observed in muscle strength, joint range, and functional abilities
Miran et al.	Ankle–Foot Orthoses with Stretching in Toe-Walking Children	To evaluate the effectiveness of ankle–foot orthoses combined with stretching exercises	Experimental interventional study	Toe-walking frequency reduced by approximately 45%, with improved ankle range of motion
Janjua et	Footwear	To assess the impact of	Prospective	Improvements noted in

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al.	Modification in Medial Knee Osteoarthritis	footwear modification strategies on activities of daily living	interventional study	KOOS pain and ADL domains following combined footwear intervention
Riaz et al.	Lateral Wedge Insoles and Physiotherapy in Knee Osteoarthritis	To examine the effects of lateral wedge insoles and physiotherapy on functional outcomes	Interventional clinical study	Both approaches improved outcomes, with greater functional independence following physiotherapy
Zaheer et al. (2021)	Phantom Exercises in Lower Limb Amputees	To assess the effects of phantom exercises on pain, mobility, and quality of life	Interventional clinical study	Greater pain reduction reported following phantom exercise intervention; mobility improved overall
Masood et al.	Group-Based Physiotherapy Following Orthopedic Surgery	To evaluate the influence of group-based rehabilitation on functional recovery and social reintegration	Prospective interventional study	Higher functional independence, lower extremity function, and social reintegration scores observed

Physiotherapy Interventions and Their Effects on Functional Mobility and Muscle Strength

Rafiq et al. (2023) investigated a home-based progressive resistance "lower limb rehabilitation protocol" (LLRP) for overweight/obese knee osteoarthritis patients (n=56) (6). They found statistically significant changes in WOMAC pain, Katz Index activities of daily living , and Timed Up and Go mobility with greater changes in pain and activities of daily living compared with the control group. The research is clinically applicable since WOMAC and TUG map could be mapped directly to the function and mobility, but due to the form of preprint, the research has not been peer-reviewed, and there is a risk of performance bias due to the use of home-based adherence. Nevertheless, the trend indicates that progressive resistance training has the potential to have a significant positive effect on functional mobility indicators among Pakistani knee OA populations. In Karachi, Mehwish et al. (2021) conducted a single-blind RCT with three intervention arms and was able to test the hypothesis that incorporation of hip joint mobilisations into hip strengthening with conventional knee exercises had better post-treatment results in pain, physical function, and dynamic balance, with significant between-group differences (7). It is the strength of this trial that it confirms a proximal control hypothesis, which is that, through the improvement of hip mechanics, knee-loading can be decreased and dynamic balance improved.

Rehan et al. evaluated pain interventions in the form of pelvic girdle in pregnant women (n=60) and also found all groups to be improved and the group with the combined physical method of Mulligan mobilization, and hip abductor strengthening was the most improved with moderate-large effect size.

Despite the fact that this is not a typical lower limb disorder, Rehan et al. remain relevant to the topic of your review since various forms of pelvic girdle dysfunctions directly relate to gait, load transfer, and mobility and hip abductor strength is an established predictor of lower-limb stability, but the findings cannot be extrapolated to the context of pregnancy-related pain (8). Iftikhar et al. (2021) compared supported standing and functional electrical stimulation (FES) during acute stroke (single-blinded RCT; 32 in each group) and found that the method improved results within- and between-groups significantly. This research enhances the position in support of concomitant neuromuscular stimulation and early weight-bearing to regain the lower-limb strength and functional mobility in the case of a stroke (9).

Testing further functional strength training in cerebral palsy hemiplegic children (n=40), Afzal et al. found significant improvements in GMFM outcomes in the intervention group compared to control

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(p=0.003), and also improvements in walking/running/jumping (10). This offers pediatric data that task-oriented strengthening can indeed result in the accrual of functional mobility, but the modest 4-week study period may demonstrate the early changes without indicating long-term maintenance. Mannan et al. (2020) employed a quasi-experimental study design in spastic diplegic CP (n=15) and discovered that the Modified Ashworth spasticity scores were lowering by 3.4±0.5 to 1.46±0.99, which is significant in the context of decreased tone but the maturation and concurrent therapy effects may not be eradicated without a control group (11). Anees et al. investigated Erb palsy and demonstrated muscle strength with significant differences (12).

Orthotic Interventions and Their Impact on Functional Outcomes, Gait, and Muscle Performance

There are more direct functional implications as pointed out by clinical evidence in Pakistan. Miran et al. compared ankle-foot orthoses with stretching exercises in children with Achilles tendon tightness who had toe walking (13). Their experimental research showed significant changes in ankle range of motion and significant changes of the toe-walking frequency, decreasing from 72% to 26% in females and from 68% to 24% in males after one month. The integration of AFOs with stretching produced functional gait normalization, supporting the role of orthoses in correcting abnormal lower-limb biomechanics when paired with active interventions.

Janjua et al. conducted a study that used medial knee osteoarthritis patients in an evaluation of footwear-based orthotic modifications (14). The difference in KOOS pain and ADL score was significantly higher in participants that were treated with lateral heel wedge insoles in combination with medial arch support than when they were treated with wedge insoles. Nevertheless, the increase in quality-of-life levels leveled off (16 weeks) indicating a diminished returns without extensive rehabilitative incorporation.

Combined Physiotherapy and Orthotic or Integrated Rehabilitation Interventions

Pakistan-based evidence of combined or integrated rehabilitation strategies demonstrates that multimodal rehabilitation strategies can generate better functional mobility and strength-related outcomes, although research outcomes are inconsistent when it comes to whether interventions are actually combined (orthotics with physiotherapy) or integrated rehabilitation (technology, cognitive strategies, or service models). Riaz et al. compared lateral wedge insoles (LWI) with traditional physical therapy (CPT) by comparing the two in the Pakistani population with knee osteoarthritis in a single-blinded pretest-posttest (n=40) (15). Both groups had an improvement in KOOS domains, however, CPT had more functional gains as compared to LWI. Even though LWI showed statistically significant change with a large effect size in pain, symptoms/stiffness, functional activities, recreational function and quality of life, there is evidence of a non-significant difference between the groups on orthotic support alone and structured physiotherapy.

Zaheer et al. (2021) studied another cognitive-motor aspect, phantom exercises, which were introduced to mirror therapy and regular physiotherapy in unilateral amputation of the lower limbs (n=24) (16). Experimental group scored much lower on VAS and better the bodily pain domain of SF-36. Nevertheless, there was an improvement in ambulatory potential (AMP) in the two groups without any significant differences between them. Nevertheless, there was no significant difference between groups and improved ambulatory potential (AMP). This suggests that while combined strategies can enhance pain control, mobility improvements may require longer follow-up, higher intensity gait training, and/or prosthetic and orthotic alignment factors to produce superior walking outcomes. Masood et al. tested a service-delivery integration model rather than a device-based intervention: group-based physiotherapy versus standard individual physiotherapy in post-orthopedic surgery patients from low-income communities (n=120) (17). The group-based program demonstrated greater improvements in functional independence (FIM mean increase 18.6±4.3 vs 13.2±3.8;) and lower extremity function (LEFS mean increase 21.4±5.1 vs 15.7±4.9), alongside higher

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reintegration scores (RNLI mean difference 6.8±2.4). While not orthotic-specific, the study supports the broader claim that combining physical rehabilitation with structured psychosocial components can amplify functional recovery.

Discussion

This is the review of the evidence that analyzed 12 studies that have explored the use of physiotherapy, orthotic, and combined rehabilitation interventions in enhancing the functional mobility and muscle strength of individuals with lower limb disorders with a specific focus on the research conducted in Pakistan. The studies that were included showed statistically significant changes in pain, functional mobility, and the outcomes related to the strength in physiotherapy-oriented interventions (n = 7). As an example, a study by Rafiq et al. (2023) showed a significant decrease in the WOMAC pain and improvement in activities of daily living measured by the Katz Index as well as a faster performance of Timed Up and Go after a 12-week progressive resistance training program in knee osteoarthritis patients. These results are in close accordance with global meta-analyses, including Fransen et al. (2015) and Goh et al. (2019), which found moderate effect sizes of exercise therapy on pain and physical functioning in a knee osteoarthritis (2,18).

Likewise, Mehwish et al. (2021) substantiated that strength training exercises combined with hip joint mobilizations led to much stronger improvements in pain, physical functioning, and dynamic balance than strength training. This is in line with international evidence presented by Bennell et al. (2016), that demonstrated proximal hip strengthening has a positive effect on knee related functions through the reduction of abnormal lower limb loading (19)

Conversely, there was more variability in orthotic-only interventions (n = 8). Miran et al. had indicated that ankle foot orthoses and stretching maintained a reduction in toe-walking frequency by 4446 temples and a significant enhancement in the ankle range of motion, similar to an international study by van Kuijk et al. (2014), which found that there was a short-term normalisation of gait with the use of ankle foot orthoses (20)

The strongest results were provided in the studies based on the use of combined or integrated rehabilitation methods (n = 6). According to Riaz et al., lateral wedge insoles have a great effect on the reduction of KOOS pain and functional scores, whereas conventional physiotherapy had more beneficial effects on functional independence. The results are comparable with the global studies, including the case of Mehrholz et al. (2018), where the combination of adherence-enhancing measures and exercise led to the best functional results (4).

5. Conclusion

The review will summarize the evidence of physiotherapy, orthotic, and combined rehabilitation interventions in enhancing functional mobility and muscle strength in patients with lower limb disorders with particular emphasis on the research studies in Pakistan. Physiotherapy-based interventions consistently demonstrated clinically meaningful improvements in pain, mobility, balance, and functional independence across musculoskeletal, neurological, and pediatric populations. Orthotic interventions produced variable outcomes, with effectiveness largely dependent on appropriate prescription, comfort, and integration with active rehabilitation. Evidence indicates that orthoses used in isolation may offer limited functional benefit and, in some cases, contribute to increased fatigue or reduced independence. The most favorable outcomes were reported in studies employing combined or integrated rehabilitation approaches, incorporating physiotherapy with orthotic support or adjunct strategies.

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