Comparative Outcomes of Conventional Physiotherapy Versus Virtual Reality–Based Rehabilitation in Post-Orthopedic Surgery Patients: A Case Review of Awka, Anambra State, Nigeria - 2025

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ABSTRACT

Recovery after orthopedic surgery largely depends on the quality and effectiveness of rehabilitation. Traditionally, conventional physiotherapy has been the main approach used to restore movement, strength, and functional independence. In recent years, virtual reality (VR)–based rehabilitation has emerged as an innovative alternative that combines therapeutic exercises with interactive digital environments. This review compares the outcomes of conventional physiotherapy and VR-based rehabilitation among post-orthopedic surgery patients, using clinical experiences and available evidence relevant to Awka, Anambra State, Nigeria. The review focuses on functional recovery, patient engagement, balance, pain management, and overall rehabilitation outcomes. Evidence from recent studies suggests that while both approaches improve physical function, VR-based rehabilitation may enhance patient motivation, adherence to therapy, and balance performance. However, challenges such as cost, limited infrastructure, and lack of technical expertise may restrict widespread adoption in low- and middle-income settings. The review highlights the potential of integrating VR into rehabilitation practice in Awka as a complementary tool rather than a replacement for conventional physiotherapy.

Keywords: Orthopedic Rehabilitation, Conventional Physiotherapy, Virtual Reality Rehabilitation, Post Surgical Recovery, Nigeria

INTRODUCTION

Orthopedic surgeries such as joint replacements, fracture fixation, and ligament reconstruction are commonly carried out to restore structural stability and relieve pain. However, surgery alone does not guarantee full recovery. Patients often experience reduced mobility, muscle weakness, pain, and difficulty performing daily activities following surgery. As a result, rehabilitation is an essential component of post-orthopedic care, with an aim of restoring function and improve quality of life (World Health Organization [WHO], 2023).

In Nigeria, including Awka in Anambra State, conventional physiotherapy remains the most widely practiced form of rehabilitation. This approach includes therapeutic exercises, manual therapy, gait training, electrotherapy, and patient education. However, conventional physiotherapy has been proven effective in improving joint mobility, muscle strength, and functional independence when properly administered (Okechukwu and Nwankwo, 2021). Despite its effectiveness, some patients find traditional rehabilitation repetitive and physically demanding, which may affect motivation and adherence, especially during long recovery periods.

Conversely, advances in health science and technology have introduced virtual reality (VR)–based rehabilitation as an alternative or complementary rehabilitation strategy. VR rehabilitation uses computer generated environments that allow patients to perform therapeutic movements in a simulated and interactive setting. These systems often provide visual and auditory feedback, making rehabilitation exercises more engaging and goal-oriented (Laver *et al.*, 2020). Recent findings indicate that VR-based rehabilitation can improve motor function, balance, and coordination while increasing patient participation and enjoyment (Howard, Rowe, and Blake, 2022).

Globally, VR has been increasingly applied in post-operative orthopedic rehabilitation, especially for knee, hip, and shoulder surgeries. Evidence suggests that VR-based therapy can achieve results comparable to conventional physiotherapy, with added benefits in motivation and treatment adherence (Yeung *et al.*, 2023). Some studies also report reduced perception of pain during VR sessions, as immersive environments distract patients from discomfort (Li, Zhou, and Chen, 2024).

Despite growing global interest, the use of VR rehabilitation in Nigeria remains limited. This is as a result of factors such as high equipment costs, limited access to technology, unstable power supply, and lack of trained personnel pose major challenges (Adebayo *et al.*, 2022). For instance, in Awka, most rehabilitation centers rely solely on conventional physiotherapy, with easy integration of digital rehabilitation tools. This gap stresses the need to examine whether VR-based rehabilitation could in reality enhance post-orthopedic recovery within this local context.

Therefore, this review aims to compare the outcomes of conventional physiotherapy and virtual reality–based rehabilitation in post-orthopedic surgery patients, using available evidence and clinical observations relevant to Awka, Anambra State. By examining functional recovery, patient engagement, and practical challenges, the review seeks to inform clinicians, policymakers, and researchers about the potential role of VR rehabilitation in improving orthopedic care in Nigeria.

METHODS

Study Design

This study adopted a narrative review design with a environmental focus on post-orthopedic rehabilitation practices in Awka, Anambra State, Nigeria. A narrative review approach was chosen because it allows for a comprehensive comparison of conventional physiotherapy and virtual reality (VR)–based rehabilitation while integrating clinical experiences, published evidence, and contextual realities of a low- to middle-income setting. This approach is useful where randomized controlled trials are limited or where emerging technologies are still being explored in clinical practice (Grant and Booth, 2020).

Literature Search Strategy

A systematic search of relevant literature was conducted between January 2020 and December 2024 to capture the most recent evidence on post-orthopedic rehabilitation. Electronic databases searched included PubMed, Google Scholar, ScienceDirect, and Cochrane Library. The search terms used were combined using Boolean operators and included “orthopedic rehabilitation”, “conventional physiotherapy”, “virtual reality rehabilitation”, “post-surgical physiotherapy”, “digital rehabilitation technologies”, and “low- and middle income countries”. Additional articles were identified through reference lists of relevant studies to ensure comprehensive coverage of the topic.

Inclusion and Exclusion Criteria

Studies were included in this review if they met the following criteria, such as published between 2020 and 2024, written in English, focused on post-orthopedic surgery rehabilitation, compared or discussed outcomes of conventional physiotherapy, VR-based rehabilitation, or both, and included adult patients (18 years and above). On the other hand, exclusion criteria were as follows: studies focusing solely on neurological rehabilitation without orthopedic relevance, conference abstracts without full-text availability, studies involving pediatric populations only, and articles lacking clear outcome measures. This selection process helped ensure that only relevant and high-quality evidence informed the review.

Local Clinical Context and Case Review (Awka)

To complement published literature, this review integrated clinical observations and case experiences from physiotherapy and rehabilitation centers in Awka. These insights were drawn from therapist reports, patient rehabilitation logs, and informal interviews with practicing physiotherapists who have experience using conventional physiotherapy and limited VR-assisted tools.

The local case review focused on patients recovering from including: fracture fixation surgeries, knee and hip joint procedures, shoulder and upper-limb orthopedic surgeries. This contextual approach helped reveal real world rehabilitation practices and challenges in Awka, including patient compliance, availability of equipment, and therapist workload.

Outcome Measures

The outcomes assessed in this review were based on commonly reported indicators in orthopedic rehabilitation research. These included:

i. Functional recovery, such as improvements in mobility, range of motion, and muscle strength
ii. Balance and coordination, especially for lower-limb surgeries
iii. Pain levels, based on patient-reported pain scales iv. Patient engagement and motivation, measured through adherence to therapy sessions and therapist observations

These domains align with rehabilitation outcome recommendations from World Health Organization, which emphasize function, participation, and quality of life as key rehabilitation goals (WHO, 2023).

Data Synthesis and Analysis

Data from selected studies and local case reports were consolidated using a thematic comparison approach. Findings were grouped under major themes such as functional outcomes, patient experience, and implementation challenges. Rather than statistical pooling, emphasis was placed on identifying similarities and differences between conventional physiotherapy and VR-based rehabilitation across different settings.

This qualitative synthesis approach allowed for meaningful interpretation of evidence, especially given the variation in study designs, outcome measures, and technology platforms used in VR rehabilitation research (Page *et al.,* 2021).

Ethical Considerations

This review relied solely on published literature and made anonymous clinical observations. No personal identifiers were used, and no direct patient contact occurred. Ethical principles of confidentiality and responsible reporting were upheld throughout the review process.

RESULTS

The findings of this review are presented by comparing outcomes of conventional physiotherapy and virtual reality (VR)–based rehabilitation across major functional areas relevant to post-orthopedic surgery patients. Evidence from international studies is integrated with clinical observations from rehabilitation settings in Awka, Anambra State.

Functional Recovery Outcomes

Across reviewed studies, both conventional physiotherapy and VR-based rehabilitation demonstrated positive effects on functional recovery, including improvements in joint range of motion, muscle strength, gait performance, and ability to perform activities of daily living. Conventional physiotherapy consistently produced significant improvements, especially in early post-operative stages, where structured exercises and manual techniques are essential for tissue healing and joint stabilization (Okechukwu and Nwankwo, 2021).

However, recent evidence indicates that VR-based rehabilitation achieves comparable or superior operational results, especially when used during the intermediate and late phases of recovery. A randomized controlled trial by Yeung *et al.,* (2023) reported greater improvements in functional mobility scores among patients who received VR-assisted therapy following knee surgery compared to those receiving conventional therapy alone. Similar trends were observed in hip and shoulder rehabilitation studies, where VR-supported exercises improved task-specific movement and coordination (Howard *et al.,* 2022).

Furthermore, clinical observations from Awka showed that patients exposed to limited VR-assisted exercises showed quicker confidence in movement and earlier return to basic functional tasks compared to patients undergoing conventional therapy only.

Balance and Coordination Outcomes

Balance and coordination are essential components of recovery following lower-limb orthopedic surgery. Notably, the reviewed evidence suggests that VR-based rehabilitation offers advantages in this domain. VR systems often include simulated environments that challenge postural control and dynamic balance, providing real-time visual feedback that enhances motor learning (Li *et al.,* 2024).

Several studies reported significant improvements in balance performance, measured using standardized balance scales, among patients undergoing VR-based therapy compared to conventional physiotherapy (Kim and Park, 2021). These findings are relevant for post-surgical patients at risk of falls.

For example, in Awka-based clinical settings, therapists reported that patients engaging in VR-style balance activities showed improved coordination and reduced fear of movement, especially among older adults recovering from lower-limb surgeries.

Pain Reduction and Pain Perception

Pain reduction is a major goal of post-operative rehabilitation. Evidence from the reviewed literature indicates that both rehabilitation approaches effectively reduce pain over time. However, conventional physiotherapy achieves pain relief primarily through therapeutic exercises, manual therapy, and electrotherapy modalities (WHO, 2023).

Moreso, VR-based rehabilitation, however, appears to influence pain perception through cognitive distraction and immersive engagement. Studies have shown that patients undergoing VR-assisted therapy reported lower perceived pain levels during exercise sessions compared to those receiving conventional therapy alone (Howard and Gutworth, 2022; Li 2024). This effect was attributed to patients focusing more on the interactive environment rather than discomfort associated with movement.

Additionally, therapists in Awka also observed that patients participating in VR-assisted sessions tolerated longer therapy durations with fewer pain complaints.

Patient Engagement, Motivation, and Adherence

One of the most consistent findings across reviewed studies was the higher level of patient engagement and motivation associated with VR-based rehabilitation. VR environments transform repetitive rehabilitation exercises into goal-oriented activities, increasing patient enjoyment and willingness to participate (Laver *et al.*, 2020).

Studies conducted between 2021 and 2024 reported improved session attendance and adherence rates among patients using VR-based rehabilitation compared to conventional physiotherapy (Adebayo *et al.,* 2022; Yeung *et al.,* 2023). Overall, improved motivation was strongly associated with better long-term functional outcomes.

In the Awka context, clinicians noted that younger patients and working adults were receptive to VR-based exercises, as these sessions felt less monotonous and more engaging than traditional routines.

Implementation Challenges and Feasibility in Awka

Despite the positive results associated with VR-based rehabilitation, several implementation challenges were identified. High initial costs of VR equipment, limited access to stable power supply, and lack of specialized training for therapists were frequently reported barriers in low-resource settings (Adebayo *et al.,* 2022).

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Conventional physiotherapy remained more feasible and accessible across rehabilitation centers in Awka due to lower costs and existing infrastructure. As a result, VR-based rehabilitation was mostly used as a supplementary intervention rather than a standalone treatment approach.

Summary of Comparative Findings

In summary, the results indicate that:

i. Both conventional physiotherapy and VR-based rehabilitation are effective in improving post-orthopedic surgery outcomes.

ii. VR-based rehabilitation demonstrates added benefits in balance training, pain perception, patient motivation, and therapy adherence.

iii. Conventional physiotherapy remains essential, especially in early recovery stages and in settings with limited resources. iv. A combined or hybrid rehabilitation model may offer the most practical and effective approach in Awka.

DISCUSSION

This review compared the beneficial effects of conventional physiotherapy and virtual reality (VR)–based rehabilitation among post-orthopedic surgery patients, with specific consideration of clinical realities in Awka, Anambra State, Nigeria. The findings show that both rehabilitation approaches contribute meaningfully to post-surgical recovery, but they differ in how they influence practical results, patient engagement, pain perception, and feasibility of implementation.

Interpretation of Functional Recovery Outcomes

The review found that conventional physiotherapy remains highly effective in improving functional outcomes such as range of motion, muscle strength, and gait performance, especially during the early stages of postoperative recovery. This supports existing evidence that hands-on techniques and therapist-guided exercises are important immediately after orthopedic surgery when tissue healing and joint protection are priorities (Okechukwu and Nwankwo, 2021).

However, VR-based rehabilitation demonstrated comparable and, in some cases, superior measurable effects during the later stages of recovery. This finding agrees with recent studies showing that task-oriented VR exercises improve motor learning and functional performance by allowing patients to practice movements in virtual environments (Yeung *et al.*, 2023). The ability of VR systems to provide instant visual feedback may explain the observed improvements in movement accuracy and confidence.

In the Awka and its environs, where rehabilitation resources are often limited, these findings suggest that VR should not replace conventional physiotherapy but rather serve as a supportive tool to strengthen functional recovery once patients are medically stable.

Balance, Coordination, and Fall Risk

Balance and coordination improvements were more noticeable in VR-based rehabilitation programs. This outcome is consistent with studies reporting that interactive spaces stimulate multisensory input, which enhances postural control and coordination (Kim and Park, 2021; Li *et al.*, 2024). VR exercises often require patients to respond to moving objects or changing environments, which closely resemble real-world balance demands.

These findings are relevant for post-orthopedic surgery patients, especially older adults who face heightened risk of falls. In Awka, where home environments may include uneven surfaces and limited assistive infrastructure, improved balance can reduce post-discharge complications significantly.

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Pain Perception and Rehabilitation Tolerance

Both rehabilitation approaches contributed to pain reduction over time, but VR-based rehabilitation showed added advantages in reducing perceived pain during therapy sessions. The immersive nature of VR appears to distract patients from discomfort, thereby making exercises more tolerable (Howard and Gutworth, 2022; Li *et al.*, 2024).

This observation is important in clinical practice, as pain is a major obstacle to therapy participation. Patients who experience less discomfort are likely to complete sessions and adhere to prescribed rehabilitation programs. In Awka, therapists reported that patients undergoing VR-assisted sessions were more willing to perform challenging movements, suggesting that VR may indirectly improve net results by increasing therapy tolerance.

Patient Engagement and Adherence

One of the critical findings of this review was the consistent improvement in patient motivation and engagement associated with VR-based rehabilitation. Conventional physiotherapy, while effective, can become repetitive and demanding, leading to reduced motivation over time. VR transforms routine exercises into interactive and goal-driven activities, which improves patient interest and commitment (Laver *et al.*, 2020).

Higher adherence rates reported in VR-supported rehabilitation programs are consistent with global evidence linking engagement to better long-term outcomes (Howard *et al.*, 2022). In Awka, younger patients and individuals with longer healing period appeared responsive to VR-based interventions.

Essentially, this finding suggests that VR rehabilitation may be valuable for patients at risk of poor compliance, a common challenge in outpatient rehabilitation environments in Nigeria.

Feasibility and Contextual Challenges in Awka

Despite the positive results associated with VR-based rehabilitation, its widespread adoption in Awka faces significant challenges. High equipment costs, inconsistent electricity supply, limited access to technical support, and insufficient training opportunities for physiotherapists remain major barriers (Adebayo *et al.*, 2022).

In contrast, conventional physiotherapy is more accessible, cost-effective, and already integrated into existing healthcare structures. As emphasized by the World Health Organization, rehabilitation technologies should be adapted to local contexts to ensure sustainability and equity (WHO, 2023).

Given these realities, a hybrid rehabilitation model, combining conventional physiotherapy with low-cost VR solutions, may represent the most practical approach for Awka and similar locations.

Implications for Clinical Practice and Policy

The findings of this review have major consequences for rehabilitation practice in Nigeria. Clinicians should consider integrating VR-based tools selectively, especially for balance training, motivation enhancement, and long-term rehabilitation phases. Policymakers and healthcare administrators should explore partnerships and funding models that support affordable digital rehabilitation technologies.

Furthermore, training programs for physiotherapists should include exposure to emerging rehabilitation technologies to prepare professionals for future practice demands.

Limitations of the Review

This review relied on a narrative synthesis of available literature and local clinical observations, rather than large-scale randomized controlled trials conducted within Awka. As a result, findings should be interpreted cautiously. The limited availability of local VR-based rehabilitation data also limits the applicability of conclusions.

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Nevertheless, the integration of global evidence with local environment provides valuable insight into realistic rehabilitation options for post-orthopedic surgery patients in Nigeria.

CONCLUSION

This review set out to compare the outcomes of conventional physiotherapy and virtual reality (VR)–based rehabilitation for patients recovering from orthopedic surgery, with specific reference to clinical practice in Awka, Anambra State, Nigeria. The evidence reviewed shows clearly that rehabilitation remains an essential component of post-orthopedic care, and that both approaches play important but different roles in supporting patient recovery.

However, conventional physiotherapy continues to be the foundation of post-operative rehabilitation in Awka and similar settings. Its structured exercises, hands-on techniques, and close therapist supervision are critical during the early stages of recovery, when patients require careful guidance to restore joint mobility, manage pain, and prevent complications. The familiarity, affordability, and availability of conventional physiotherapy make it indispensable within the Nigerian healthcare system.

At the same time, this review demonstrates that VR-based rehabilitation offers meaningful additional benefits, especially in later stages of recovery. VR-based interventions consistently show advantages in improving balance, coordination, patient motivation, and adherence to therapy. The interactive and engaging nature of VR helps reduce perceived pain during exercises and encourages patients to remain actively involved in their rehabilitation process. These benefits are important for patients undergoing long-term rehabilitation, where fatigue, boredom, and poor compliance often limit outcomes.

More importantly, the findings of this review suggest that VR-based rehabilitation should be seen not as a replacement, but as a complementary tool to conventional physiotherapy. In the context of Awka, where challenges such as cost, infrastructure limitations, and limited technical expertise remain significant, a combined or hybrid rehabilitation method appears to be the most practical and effective model. Therefore, integrating affordable VR solutions into existing physiotherapy services could enhance rehabilitation outcomes without placing excessive strain on healthcare resources.

In conclusion, both conventional physiotherapy and VR-based rehabilitation are effective in improving postorthopedic surgery outcomes. However, the thoughtful integration of VR technology into conventional rehabilitation practice holds promise for improving patient experience and functional recovery in Awka, Anambra State. Hence, future research involving larger local studies and long-term follow-up is needed to strengthen the evidence base and guide sustainable implementation of VR-assisted rehabilitation in Nigeria.

RECOMMENDATIONS

Based on the findings of this review and the contextual realities of post-orthopedic rehabilitation in Awka, Anambra State, several practical and policy-oriented recommendations can be made to optimize patient recovery and enhance the effectiveness of both conventional physiotherapy and virtual reality (VR)–based rehabilitation.

Integration of Hybrid Rehabilitation Models

With the demonstrated benefits of VR-based rehabilitation in balance, functional recovery, and patient engagement, it is recommended that clinics in Awka adopt a hybrid approach that combines conventional physiotherapy with VR-assisted exercises. Such an approach allows patients to benefit from the proven efficacy of traditional therapy while taking advantage of the motivational and cognitive benefits of VR. For example, conventional therapy can be adopted in early recovery phases for tissue healing, while VR exercises can be introduced later to enhance balance, coordination, and adherence (Yeung *et al.*, 2023; Li *et al.*, 2024).

Investment in Affordable VR Technologies

One of the major barriers to VR adoption in Awka is cost and limited accessibility of VR equipment. Policymakers, healthcare administrators, and private sector partners should explore funding models, subsidies, or low-cost VR solutions to make digital rehabilitation more accessible. Collaborations with technology

providers could help acquire scalable VR systems suitable for clinical settings in low- and middle-income contexts (Adebayo *et al.,* 2022).

Training and Capacity Building for Physiotherapists

Effective implementation of VR-based rehabilitation requires physiotherapists to be trained in both the technical operation of VR systems and the integration of VR exercises into standard therapy plans. Structured capacity-building programs, workshops, and continuing professional development courses should be established in Awka to enhance therapist competence and confidence. Training should also cover patient assessment, progression planning, and monitoring of VR therapy outcomes (Howard and Gutworth, 2022).

Patient-Centered Rehabilitation Planning

Rehabilitation plans should be tailored to individual patient needs, preferences, and recovery timelines. Also, clinicians should consider factors such as age, type of orthopedic surgery, coexisting conditions, and technological literacy when designing rehabilitation programs. VR exercises can be beneficial for patients who show poor motivation or require additional cognitive and sensory stimulation during therapy sessions (Laver *et al.,* 2020).

Monitoring and Evaluation

To ensure the effectiveness and sustainability of VR-assisted rehabilitation, regular monitoring and evaluation of patient net-results should be conducted. However, standardized outcome measures, including functional recovery scores, balance assessments, pain ratings, and adherence rates, should be collected systematically. This data can help refine rehabilitation protocols, justify investments, and guide future research in the Nigerian context (WHO, 2023).

Policy and Infrastructure Support

At the systemic level, healthcare policymakers should create guidelines and policies that support the integration of innovative rehab solutions/ therapies within public and private healthcare systems. Infrastructure support such as reliable electricity, internet connectivity, and dedicated rehabilitation centers will enhance effective implementation of VR-based therapy. Therefore, national and local health authorities can also encourage partnerships with academic institutions to strengthen research and innovation in rehabilitation technologies (Adebayo *et al.,* 2022; Howard *et al.,* 2022).

Recommendations for Future Research

Finally, there is a need for well-designed, large-scale studies in Nigeria to evaluate the long-term effectiveness, cost-benefit ratio, and patient satisfaction associated with VR-based rehabilitation. Comparative trials involving different age groups, orthopedic procedures, and hybrid rehabilitation models will provide stronger evidence to guide clinical practice and policy decisions in low-resource settings.

In summary, these recommendations emphasize a practical, patient-centered, and sustainable approach to postorthopedic rehabilitation in Awka. By combining conventional physiotherapy with VR-assisted exercises, investing in affordable technology, training therapists, and implementing supportive policies, it is possible to strengthen patient outcomes, engagement, and general quality of rehabilitation services.

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