Efficacy of Task-Oriented Interventions in Upper Extremity Rehabilitation Following Stroke: A Systematic Review

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Abstract

A stroke can cause significant dysfunction of the upper limb, severely affecting performance in everyday occupations. The task-oriented approach is grounded in occupational therapy principles and emphasizes the use of meaningful occupations to promote functional recovery. This review examines the effectiveness of the task-oriented approach during occupational therapy rehabilitation of the upper extremity following stroke. A comprehensive search was conducted on English-language literature published between 2018 and 2023, utilizing the databases Medline, Scopus and Google Scholar, as a supplementary source. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, an intensive screening process led to the inclusion of 16 relevant articles in this review. The methodological quality of the studies was assessed using the PEDro Scale. A narrative synthesis was conducted to summarize and interpret the findings of the included studies, which consisted of controlled trials examining the effectiveness of task-oriented interventions delivered alone or in combination with other rehabilitative approaches. The task-oriented approach was studied alongside (a) assistive technology, (b) the Bobath method, (c) mirror therapy, (d) Botulinum Toxin injections, and (e) other therapeutic techniques. Findings indicate that these interventions effectively enhance motor function, self-perceived arm use, and performance in activities of daily living. Integrating task-oriented therapy with the aforementioned therapeutic techniques is effective in managing the hemiplegic upper extremity after stroke. This review supports the implementation of the task-oriented approach in upper limb stroke rehabilitation, either alone or combined with other approaches. Nevertheless, due to the high heterogeneity of the task-oriented interventions studied, further research is required to comprehensively assess their efficacy in upper limb rehabilitation.

Keywords: task-oriented approach, stroke, upper limb rehabilitation, occupational therapy.

Abordagem Orientada à Tarefa na Reabilitação Ocupacional do Membro Superior Após Acidente Vascular Cerebral

Resumo

Um acidente vascular cerebral (AVC) pode causar disfunção significativa no membro superior, impactando negativamente o desempenho nas atividades ocupacionais diárias. A abordagem Orientada à Tarefa é centrada na ocupação e visa auxiliar os indivíduos a se envolverem com sucesso nas ocupações que precisam ou desejam realizar. Esta revisão examina a eficácia da abordagem Orientada à Tarefa durante a reabilitação ocupacional do membro superior após AVC. Foi realizada uma pesquisa abrangente da literatura publicada em língua inglesa entre os anos de 2018 e 2023, utilizando as bases de dados Google Scholar, Medline e Scopus. Seguindo as diretrizes Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), um rigoroso processo de triagem resultou na inclusão de 16 artigos relevantes nesta revisão. A qualidade metodológica dos estudos foi avaliada por meio da Escala PEDro. Uma síntese narrativa foi conduzida para resumir e interpretar os achados dos estudos incluídos. Foram considerados ensaios clínicos controlados que examinaram a eficácia das intervenções Orientadas à Tarefa realizadas isoladamente ou combinadas com outras abordagens reabilitativas. A abordagem Orientada à Tarefa foi estudada em associação com tecnologia assistiva, método Bobath, terapia de espelho e

outras técnicas terapêuticas. Os resultados demonstram que essas intervenções são eficazes para melhorar a função motora, a percepção do uso do braço e o desempenho nas atividades da vida diária. Integrar a terapia Orientada à Tarefa às técnicas terapêuticas mencionadas constitui uma estratégia eficaz para o manejo do membro superior hemiplégico após AVC. Esta revisão reforça a importância da implementação da abordagem Orientada à Tarefa na reabilitação do membro superior após AVC, tanto isoladamente quanto em combinação com outras técnicas. Entretanto, devido à alta heterogeneidade das intervenções analisadas, recomenda-se a realização de mais pesquisas para avaliar de maneira abrangente sua eficácia na reabilitação do membro superior após AVC.

Palavras-chave: abordagem Orientada à Tarefa, AVC, reabilitação do membro superior, terapia ocupacional.

1. Introduction

Stroke is the second leading cause of death in Greece, according to EU's Country Health Profile (OECD, 2025), and one of the primary causes of acquired disability in adults worldwide (Katan et al., 2018; O'Flaherty; Ali, 2024). Specifically, stroke can cause significant extremity dysfunction, often resulting in upper limb hemiplegia, which is the most common consequence. (Hatem et al., 2016; Li et al., 2017).

Upper extremity impairments caused by stroke, as classified within the Body Functions domain of the International Classification of Functioning, Disability, and Health (ICF) (Geyh et al., 2004), include loss of voluntary movement control, abnormal muscle tone, and altered sensory functions (Raghavan, 2015; Hatem et al., 2016; O'Flaherty; Ali, 2024). These deficits can reinforce a behavioral pattern known as learned non-use, in which individuals increasingly rely on the unaffected upper limb while failing to incorporate the hemiplegic limb into everyday tasks (Raghavan, 2015). As a result, such impairments—and the compensatory behaviors they foster—are of particular concern to occupational therapists, due to their substantial negative impact on the performance of activities of daily living (ADLs), such as eating, dressing, and grooming (Frank et al., 2017).

Occupational therapy is a health profession where participation in meaningful occupations serves as both the means and the goal of therapy (AOTA, 2020). In this context, occupational therapists Mathiowetz and Bass-Haugen developed the task-oriented approach (Mathiowetz & Haugen, 1994), an occupation-focused (top-down) method applied throughout the occupational therapy process, including assessment, goal setting, and intervention. The primary objective of this approach is to facilitate individuals in successfully engaging in activities that are important for assuming their life roles and occupations they must, need, or want to fulfil. (Preissner, 2010; Mathiowetz, 2020)

A key principle of the task-oriented approach is that the therapy environment and activities practiced reflect the common challenges of everyday life. This is achieved by incorporating everyday objects and stimulating areas within the home (e.g. kitchen). A familiar environment, combined with graded feedback, helps clients develop and evaluate their own strategies for performing occupations. This process facilitates the generalization of those strategies to new and varied contexts. (Mathiowetz, 2020)

Despite the extensive literature on this approach, only a few systematic reviews specifically assessed its effectiveness in upper limb rehabilitation. To the best of our knowledge, as of November 2023, systematic reviews have examined the task-oriented approach for both upper and lower extremities (Jeon et al., 2015; French et al., 2016), as well as in combination with specific therapeutic strategies (Peters et al., 2015; Rozevink et al., 2023; Xi et al., 2023). Therefore, this systematic review synthesizes the most recent evidence regarding the effectiveness of the task-oriented approach on upper limb function in post-stroke patients.

2. Materials and Methods

2.1 Search Strategy

This systematic review adheres to the guidelines for conducting systematic reviews as proposed by Randles and Finnegan (2023). A literature search was conducted on November 30, 2023, aiming to gather the most recent evidence on the use of the task-oriented approach in upper extremity occupational therapy interventions after stroke. Studies published in the last five years (2018-2023) were identified through searches in the databases Scopus, MEDLINE and Google Scholar, as a supplementary source, to ensure comprehensive coverage. Given the large volume of literature, a five-year restriction was applied to ensure the relevance and feasibility of the review. A Boolean search strategy was applied using the keywords "task-oriented," "task-specific," "stroke," "occupational therapy," "upper limb," and "upper extremity." These terms were combined using both *and* and *or* operators to refine the search. Phrase searching with quotation marks was applied for multi-word terms (e.g., "occupational

therapy"), but no truncation symbols were used.

2.2 Selection Criteria

Keywords were required to be mentioned in the title and/or abstract of the article. Articles published in English between January 2018 and November 2023 with full-text availability were considered for inclusion. Additionally, studies included in this review had to meet the following criteria:

(a) the sample comprised adults with stroke at any recovery stage;

(b) the task-oriented approach was applied as either the main intervention or the control condition; and

(c) the study's objective was to evaluate the effectiveness of the approach on upper extremity function and/or occupational capability.

Finally, only controlled trials (randomized or non-randomized) were included in this review. Pilot randomized controlled trials (RCTs) and quasi-experimental studies were also included due to the limited number of full-scale RCTs on this topic.

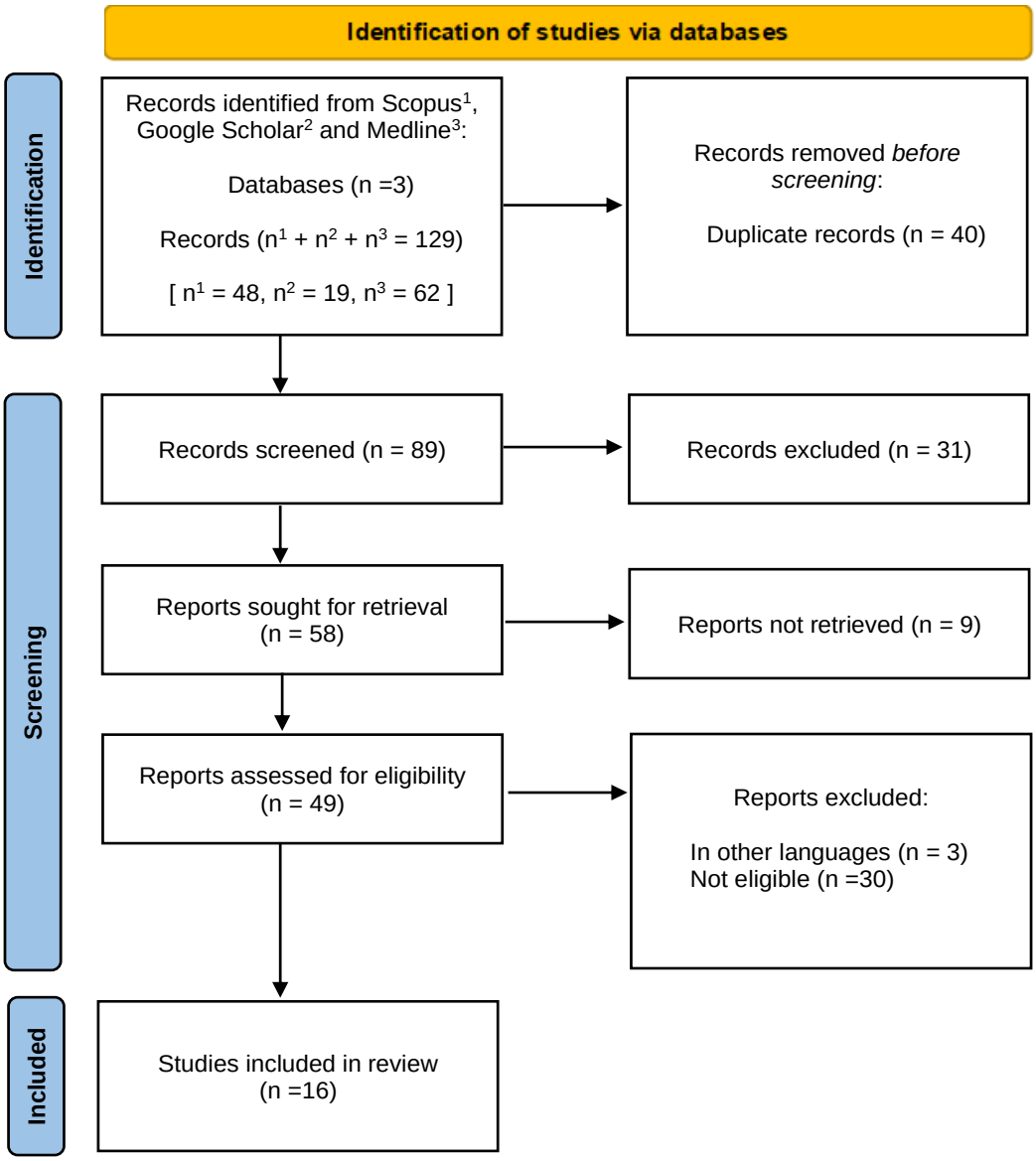

Figure 1. PRISMA flowchart showing the study selection process. Source: Page et al., 2021.

2.3. Screening and Data Extraction

The PRISMA 2020 guidelines for systematic reviews (Page et al., 2021) were followed to screen and extract data. One author (R.P.) screened all titles and abstracts of the articles identified through the search strategy. Full-text eligibility decisions were reviewed and discussed with a second author (P.V.) in cases of uncertainty, until consensus was reached. The full texts of the pre-selected studies were then reviewed to determine the final selection of articles.

The quality of the selected controlled studies was assessed by one author (R.P.) using the Physiotherapy Evidence Database (PEDro) scale, an 11-item tool for evaluating the methodological quality of randomized controlled trials. Although the assessment was not conducted independently in duplicate, results were reviewed and discussed with a second author (P.V.) to ensure consistency.

3. Results

3.1 Study Selection

As illustrated in Figure 1, a total of 129 articles were identified based on the searched keywords. After screening the titles and abstracts according to the pre-established selection criteria, 16 studies were included in the final analysis.

3.2 Methodological Quality of Included Articles

According to the PEDro Scale, most studies scored ≥6/10, with an average Pedro score of 7.1 (range: 6–8), indicating an overall "good" methodological quality. However, the study by Yu et al. (2021) scored 4/10, classifying it as having "fair" methodological quality, and its results should therefore be interpreted with caution. The main limitations of the included controlled trials were the impossibility of blinding participants and therapists, as well as lack of intention-to-treat analysis, since data from participants who dropped out were excluded from the analysis (Table 1).

Table 1. Methodological quality of included controlled studies (PeDro scale).

	PEDro Final Score	Eligibility criteria (item does not score)	Random allocation	Concealed allocation	Baseline comparability	Blinding of participants	Blinding of therapist	Blinding of assessors	Adequate follow-up (>85%)	Intention-to-treat analysis	Between-group statistical comparisons	Variability of point measures
Pongtham et al.	6/10	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Alsubiheen et al.	7/10	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
Choi Wonho	6/10	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes
Moon et al.	6/10	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes	Yes
Firoozeh et al.	8/10	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Page et al.	7/10	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes
Lee et al.	7/10	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes
Chen et al.	6/10	Yes	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes
Hsu et al.	8/10	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Bai et al.	8/10	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Li et al.	8/10	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Umar et al.	7/10	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes
Hung et al.	8/10	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Song et al.	8/10	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Ozen et al.	7/10	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes
Yu et al.	4/10	Yes	Yes	No	Yes	No	No	No	No	No	Yes	Yes

Note: Methodological Quality based on Final Score: "Poor" (<4), "Fair" (4-5), "Good" (6-8), "Excellent" (9-10). Source: Cashin; McAuley, 2020.

Additionally, while four pilot RCTs (Bai et al., 2019; Choi, 2022; Hung et al., 2022; Moon et al., 2018) and one

Quasi-Experimental Control Trial (Pongtham et al., 2022) were included in this review, only three studies (Bai et al., 2019; Hung et al., 2022; Pongtham et al., 2022) reported conducting a power analysis for sample size estimation. Of these, two studies (Hung et al., 2022; Pongtham et al., 2022) met their estimated sample size requirements, whereas Bai et al. (2019) did not reach the estimated number of participants. Correspondingly, both Randomized Cross-Over Trials included in this review (Chen et al., 2022; Lee et al., 2021) applied a one-month washout period. However, only one study (Chen et al., 2022) statistically confirmed a negligible carryover effect. These methodological aspects should be considered when assessing the reliability and applicability of the studies' findings.

3.3 Study Analysis

Our analysis revealed substantial heterogeneity in the task-oriented interventions applied across the literature, along with considerable variation in delivery methods, outcome measures, and participant characteristics — especially time since stroke. Therefore, a quantitative synthesis was not considered appropriate, and a narrative synthesis was adopted to accurately reflect and interpret the findings.

Moreover, study analysis was organized into six main task-oriented intervention categories:

(1) conventional task-oriented intervention (Alsubiheen et al., 2022; Choi, 2022; Pongtham et al., 2022),

(2) task-oriented approach and Bobath therapy (Firoozeh et al., 2019; Moon et al., 2018),

(3) robot-assisted and task-oriented therapy (Chen et al., 2022; Hsu et al., 2019; Lee et al., 2021; Page et al., 2020),

(4) task-oriented mirror therapy (Bai et al., 2019; Li et al., 2019),

(5) task-oriented therapy following botulinum toxin (BoNT-A) injections (Hung et al., 2022; Umar et al., 2018),

(6) task-oriented approach in combination with other therapeutic techniques (Ozen et al., 2021; Song et al., 2019; Yu et al., 2021).

A table was developed by consensus of the team to summarize the main characteristics of each study, including the main author, year and country of research, interventions, participants and main study results. Data extraction was performed by a single reviewer (R.P.). The resulting table was subsequently reviewed and verified by a second researcher (P.V.) for consistency and accuracy. The data extracted from the 16 studies included are presented in Table 3.

3.3.1 Characteristics of the Included Studies

In total, 9 Randomized Controlled Trials (Alsubiheen et al., 2022; Firoozeh et al., 2019; Hsu et al., 2019; Li et al., 2019; Ozen et al., 2021; Page et al., 2020; Song et al., 2019; Umar et al., 2018; Yu et al., 2021), 2 Randomized Cross-Over Trials (Chen et al., 2022; Lee et al., 2021), 4 Pilot Randomized Controlled Trials (Bai et al., 2019; Choi, 2022; Hung et al., 2022; Moon et al., 2018), and 1 Quasi-Experimental Control Trial (Pongtham et al., 2022) were identified.

Nearly all the studies were conducted in Eastern countries, apart from two that were carried out in the USA (Page et al., 2020; Yu et al., 2021). Specifically, the studies were conducted in the following countries: 5 in Taiwan (Chen et al., 2022; Hsu et al., 2019; Hung et al., 2022; Lee et al., 2021; Li et al., 2019), 4 in Korea (Alsubiheen et al., 2022; Choi, 2022; Moon et al., 2018; Song et al., 2019), and 1 each in Pakistan (Umar et al, 2018), Thailand (Pongtham et al., 2022), Iran (Firoozeh et al., 2019), China (Bai et al., 2019), and Turkey (Ozen et al., 2021).

Lastly, all studies reported the total amount of therapy participants received, which varied from 10 to 30 hours.

This overview illustrates the predominance of studies conducted in Eastern countries, as well as the variability in both study designs (primarily consisting of RCTs) and intervention durations.

3.3.2 Characteristics of the Participants

First and foremost, it must be noted that relevant data from the overall sample of each study were utilized, as the interventions provided to the intervention and control groups differed significantly among studies. By contrast, all the included studies, except for one (Chen et al., 2022), report that the participants' characteristics at baseline did not statistically differ. Moreover, data extracted from the 16 included Controlled Trials involved in total 452 participants.

Demographic data on gender and age were collected from the participants in most of the included studies, while data on the dominant hand prior to stroke was addressed by only a minority of studies. The most commonly reported stroke-related data were stroke chronicity, type of stroke (ischemic/hemorrhagic), and affected side (left/right).

Regarding the age (mean ±SD) of the participants, it was calculated to be 55.9 ± 12.6 years. Gender was mentioned in all but one (Firoozeh et al., 2019) of the included studies, with men comprising the majority of the participants (66.2%). With exception of the three studies (Bai et al., 2019; Choi, 2022; Moon et al., 2018) that focused solely on participants in the subacute phase of stroke (early or late subacute) and four studies that examined participants in the late subacute to chronic phase (Chen et al. 2022; Lee et al. 2021; Ozen et al. 2021; Firoozeh et al. 2019), all other studies included only participants in the chronic phase. Thus, the mean period following the cerebrovascular accident of the participants was determined to be 15.0 ± 23.1 months. Moreover, a larger proportion of studies reported the type of stroke, with individuals who had ischemic stroke representing 56.8% of the sample. The number of participants with left-sided strokes (196) was approximately equal to those with right-sided strokes (199). Two studies did not disclose the affected side (Firoozeh et al., 2019; Hsu et al., 2019). Lastly, among the studies that reported hand dominance, 46% of participants exhibited a match between the affected hand and the dominant hand (Alsubiheen et al., 2022; Hsu et al., 2019; Moon et al., 2018; Page et al., 2020; Yu et al., 2021). These findings are summarized in Table 2.

Table 2. Overview of Study Participants' Characteristics.

Author (Year)	Sample Size (n)	Mean Age	Sex (F/M)	Lesion Hem. (L/R)	Dominat side Affected (n)	Stroke Type (Isc./Hem.)	Stroke Chronicity (mo)	Stroke Phase
Pongtham et al.	20	52.6 ± 4.7	2/18	7/13	15/5	3/17	40.0 ± 7.9	Chronic
Alsubiheen et al.	30	57.1 ± 10.8	7/23	21/9	NR	NR	NR	Chronic
Choi Wonho	20	57.1 ± 10.7	5/15	11/9	NR	NR	1.4 ± 0.4	Early Subacute
Chen et al.	24	58.9 ± 11.0	5/15	9/15	NR	13/11	46.5 ± 39.1	Late Subacute - Chronic
Hsu et al.	43	52.8 ± 13.0	23/20	NR	22/21	NR	14.1 ± 10.9	Chronic
Moon et al.	18	67.0 ± 10.7	8/10	8/10	10/8	NR	0.6 ± 0.16	Early Subacute
Firoozeh et al	14	59.1 ± 10.5	NR	NR	NR	NR	6.7 ± 2.6	Early Subacute -Chronic
Page et al.	31	55.3 ± 9.4	13/18	21/10	7/24	NR	NR	Chronic
Lee et al.	24	57.0 ± 10.3	8/16	17/7	NR	13/11	NR	Late Subacute- Chronic
Ozen et al.	30	65.9 ± 11.5	10/20	19/11	NR	25/5	4.8 ± 2.9	Late Subacute- Chronic
Bai et al.	34	56.2 ± 13.3	9/25	15/19	NR	16/18	2.3 ± 1.5	Early - Late Subacute
Li et al.	23	54.5 ± 10.5	10/13	10/13	NR	12/11	53.0 ± 31.5	Chronic
Song et al.	49	61.8 ± 14.6	15/34	10/39	NR	34/15	14.0 ± 6.6	Chronic
Umar et al.	41	46.1 ± 11.0	17/24	12/29	NR	NR	NR	Chronic
Hung et al.	37	47.2 ± 11.2	13/24	26/11	NR	21/16	34.8 ± 21.3	Chronic
Yu et al.	14	55.8 ± 11.0	3/11	10/4	4/10	8/6	53.1 ± 26.5	Chronic
Total	452	55.9 ± 12.6	148/290	196/199	58/68	145/110	15.0 ± 23.1	

Note: F/M= Female/Male, L/R= Left/Right, Isc./Hem.= Ischemic/Hemorrhagic, mo= months, NR= Not reported.

3.4. Outcomes of Studies

The outcomes of the studies were evaluated using various assessment scales (Table 3). However, the primary focus across all studies was on upper limb function and occupational performance. Most studies evaluating overall upper extremity sensorimotor function employed the Fugl-Meyer assessment Scale (Fugl-Meyer et al., 1975), while only a few used more specialized assessments for sensory function or gross manual dexterity, such as the Revised Nottingham Sensory Assessment (Lincoln et al., 1998) and the Box and Block test (Mathiowetz et al., 1985), respectively. A broad range of tools were utilized across studies to assess upper limb functional ability in task performance, including the Wolf Motor Function Test (Wolf et al., 1989) and the Manual Function Test (Michimata et al., 2008). To evaluate the ability to perform Activities of Daily Living (ADLs), the Motor Activity Log (Uswatte et al., 2005) was the primary tool used measuring both frequency of use and quality of movement

of the hemiplegic upper extremity during performance. Lastly, the Canadian Occupational Performance Measure (Law et al., 1990) predominated in assessing self-perceived occupational performance, while the Modified Barthel Index (Shah; Cooper, 1989) was commonly employed to assess independence in ADLs.

Mixed results were found regarding the effectiveness and superiority of task-oriented interventions in improving upper limb functionality. The following sections will review the reported outcomes of the studies for each category of task-oriented intervention.

3.4.1. Conventional Tak-Oriented Therapy

Three of the included studies focused on comparing the effectiveness of practicing Activities of Daily Living (such as dressing, dishwashing and/or meal-prepping) with a conventional occupational therapy program (Alsubiheen et al., 2022; Choi, 2022; Pongtham et al., 2022). Research indicates that both types of intervention can lead to notable enhancements in upper limb function and occupational performance (Alsubiheen et al., 2022; Choi, 2022). Specifically, significant progress ($p<0.001$) in motor skills of the affected upper extremity and in capacity for Activities of Daily Living, were obtained in both intervention and control groups. Although the task-oriented approach resulted in a greater magnitude of improvement in both studies, these outcomes did not reach significance (Alsubiheen et al., 2022; Choi, 2022). Similar results were reported by Pongtham et al. (2022) regarding both objective and subjective performance efficacy. The task-oriented approach led to a significantly greater increase ($p<0.05$) in both measures, compared to a conventional occupational therapy program (Pongtham et al., 2022).

3.4.2. Task-Oriented Approach Combined with Bobath Therapy

Regarding the comparison between task-oriented and Bobath approaches, Moon et al. (2018) found that task-oriented approach utilizing rehabilitation tools led to significant improvements ($p<0.05$) in the FMA scale and in quality of movement of the affected upper limb during MAL performance, comparable to those achieved with an equivalent amount of Neurodevelopmental treatment in acute stroke patients. Similarly, Firoozeh et al. (2019) reported that post-stroke patients across all recovery phases benefit equally from a combined task-oriented and bobath approach therapy as from a task-oriented therapy alone.

3.4.3. Robot-Assisted Therapy Integrated with a Task-Oriented Approach

This subsection, which addresses robot-assisted and task-oriented therapies, identifies two major categories of studies. The first category examines the superiority of one intervention over the other (Chen et al., 2022; Hsu et al., 2019), while the second also focuses on the outcomes of combining these two therapies (Lee et al., 2021; Page et al., 2020).

The study by Hsu et al. (2019) compared the effectiveness of robot-assisted repetitive bilateral forearm practice to task-oriented activities targeting the distal upper extremity. The results indicated that both interventions led to significant within-group improvements ($p<0.05$) in upper limb function and amount of use of the hemiplegic upper limb. Notably, the robot-assisted group exhibited superior wrist motor function, whereas the task-oriented therapy group showed more pronounced benefits in grasp ability ($p<0.05$, respectively). Additionally, *FMA* score improvements were sustained at follow-up ($p<0.05$) in both treatment groups; however, robot-assisted therapy significantly outperformed across outcome measures ($p\leq0.006$). (Hsu et al., 2019)

Chen et al. (2022) divided the participants into two groups. The first group initially received robot-assisted therapy utilizing electromyography (EMG) sensors on the hand, followed by a wash-out period and then task-oriented intervention, while the second group underwent the same interventions in reverse order. The study's findings revealed that, in the group receiving robot-assisted therapy first, the EMG-driven intervention significantly improved sensorimotor function ($p<0.05$), whereas the task-oriented intervention produced significant improvements in both groups. Additionally, both interventions yield significant ($p<0.05$) and nearly equal effects on functional motor ability. Finally, significant increase ($p\leq0.03$) in affected arm use was observed following the task-oriented intervention, while improvements in movement quality were noted after the second intervention protocol, regardless of group. (Chen et al., 2022)

Similarly, Page et al. (2020) conducted a study to compare outcomes of (a) repetitive task-specific approach, (b) therapy using an EMG elbow device, and (c) a combination of the two therapies, with respect to their effects on upper limb function. The treatments demonstrated nearly equivalent beneficial effects on sensorimotor function ($p=0.83$) and activity limitations in ADLs ($p=0.61$) of the affected upper extremity. (Page et al., 2020)

Finally, Lee et al. (2021) employed an exoskeleton glove in a task-oriented approach to compare its effectiveness on the upper extremity function with that of conventional task-oriented therapy. The results showed statistically significant improvements ($p<0.05$) in upper limb function and ADL performance only for the group that received the robot-assisted task-oriented therapy, without reaching intergroup significance ($p>0.1$). Additionally, incorporating an exoskeleton glove into the task-oriented intervention appeared to enhance the therapy's effect on hand extensor muscles, as indicated by the Box and Blocks Test (between-group; $p=0.05$). However, neither therapy resulted in considerable benefits in grip strength or upper extremity sensation (Lee et al., 2021).

Table 3. Description of the included articles.

Type of TOT	Authors, Date, Location	I.G.	C.G.	Duration	Part., Time post-stroke	Results
CONVENTIONAL	Pongtham et al. (2022), Thailand	TOT + usual rehabilitation training	Usual rehab. training	6 weeks 3x a week 60 min/ session	N = 20, ≥ 6 months	Major ($p<.05$) objective & subjective performance outcomes (FTHUE & COMP) in the I.G., with significant greater change ($p<.05$) than the C.G.
	Alsubiheen et al. (2022), Korea	Task- oriented ADL training (T-ADL)	Usual OT	8 weeks 5x a week 45 min/ session	N = 30, ≥ 6 months	T-ADL training led to greater increase of the UL function and gross manual dexterity (MFT, BBT) compared to conventional OT. Contrariwise, SS-QoL score and ADL performance (MBI) highly increased ($p=0.004$ and $p<0.001$ respectively) in either group.
	Choi Wonho (2022), Korea	T0T	Table-top activity training	6 weeks 5x a week 30 min/ session	N = 20, ≤ 3 months	Both groups showed significant improvement ($p<0.001$) in UL function, visual perception, and ADL performance (MFT, MVPT-V, MBI). There was no considerable group difference, although motor and performance progress were greater in TOT than table-top activity group.
BOBATH	Moon et al. (2018), S. Korea	Circuit TOT	NDT	4 weeks 5-6x a week 30 min/ session	N = 18, ≤ 1 month	Both groups demonstrated a marked change ($p<.05$) in functional recovery (FMA, MAL, SIS), with the I.G. showing overall greater progress.
	Firoozeh et al. (2019), Iran	TOT + Bobath	TOT	5 weeks 3x a week 60 min/ session	N = 14, 2 ≤ months ≤ 12	Interventions showed comparable therapeutic effect in functional measures of the UL (FMA, Grip Strength, WMFT, MBI). However, only the C.G. achieved statistically significant improvement ($p\leq.05$) in almost all assessment measures.
ROBOT-ASSISTED	Page et al. (2020), USA	Myoelectric device (Myomo)	C.G[1]: RTP C.G[2]: RTP + Myomo	8 weeks 3x a week 60 min/ session	N = 31 > 12 months	Treatments showed an almost equal beneficial effect ($p=.83$) in the UL's function (FMA). The performance of ADL (AMAT) in the Myomo groups revealed similar progress, which was less than in the RTP group (C.G[1]) without statistically significant difference ($p=.61$).
	Lee et al. (2021),	Robot-assisted TOT (Gloreha	Usual TOT	6 weeks 2x a week 60 min/	N = 24 ≥ 3 months	Robot-assisted therapy indicated significant improvement ($p<.05$) in function of the UL (FMA) and ADL ability

	Taiwan	device)		session washout: 4 weeks	(MBI). Furthermore, the I.G. showed more effective (p=.05) extensor muscles (EMG) during the small-block grasping activity (BBT). No other significant difference was noted between treatments.

(Continued)

Table 3. Description of the included articles (Continued).

Type of TOT	Authors, Date, Location	I.G.	C.G.	Duration	Part., Time post-stroke	Results
ROBOT-ASSISTED	Chen et al. (2022), Taiwan	EMG-driven robot-assisted therapy	TOT	4 weeks 3x a week 70 min/ session washout: 4 weeks	N = 24 ≥ 3 months	Both treatments appeared to be equally effective in improving the functional performance of the UL (WMFT, ARAT). On the contrary, I.G. showed greater improvement in duration of performance (WMFT-Time), while C.G. in UL function (FMA) and participation (AOU-MAL).
	Hsu et al. (2019), Taiwan	Usual care + robot-assisted therapy with BAT (Bi-Manu-TrackTM)	Usual care + task-specific training	4 weeks 3x a week 50 min/ session	N = 43> 6 months	Significant improvement (p<.05) in the amount of use (AOU-MAL) and UL function (FMA) presented in either group, but quality of UL movement (MAL) only in the I.G. (p=.001). Between-group interaction revealed a more positive effect of the I.G. therapy in AOU at follow-up (p<.001) and activation of the wrist muscles at treatment endpoint and follow-up (sEMG).
MIRROR	Bai et al. (2019), China	Movement-based MT + TOT	C.G[1]: Task-based MT + TOT C.G[2].: TOT	4 weeks 5x a week 90 min/ session	N = 34 1 ≤ months ≤ 6	Movement MT lead to greater improvement (p≤.05) of the UL motor impairment (FMA) over the therapies compared. However, all groups had similarly high progress (p≤.001) in functionality (WMFT), spasticity (MAS), grip strength (Jamar dynamometer) and ADL performance (MBI). Overall, adding MT in TOT sessions seemed to have a positive impact (p>.05) on increasing functionality (WMFT).
	Li et al. (2019), Taiwan	Hospital & home-based task-oriented MT	Hospital & home-based task-oriented BAT	4 weeks Hospital: 3x a week, 90 min Home: 5x a week, ≈ 40 min	N = 23 > 6 months	No statistically significant differences were found between the treatments' outcomes regarding the UL's function (FMA). The I.G. showed a marked change in quality of life (SIS) and tended to have a greater improvement in temperature sense (RNSA), amount of use and quality of movement (MAL) than the C.G. group.

BoNT-A	Hung et al. (2022), Taiwan	BoNT-A + robot-assisted TOT	C.G[1]: BoNT-A + task-oriented MT C.G[2]: BoNT-A + task-oriented BAT	8 weeks 3x a week 75 min/ session	N = 37 ≥ 6 months	All treatments had an equally positive effect in movement and spasticity of the UL (FMA, MAS) both post-treatment (p>.073) and at three-months follow-up (p>.45). Scores on MAL improved comparably among groups, but the C.G[2] group yield a superior effect (p< .05) in QOM at follow-up.

(Continued)

Table 3. Description of the included articles (Continued).

Type of TOT	Authors, Date, Location	I.G.	C.G.	Duration	Part., Time post-stroke	Results
BoNT-A	Umar et al. (2018), Pakistan	BoNT-A + task-specific training	Task-specific training	8 weeks 3x a week 60 min/ session	N = 41 ≥ 6 months	Statistically significant improvements (p<.01) were noted in motor function (FMA, Motor Assessment Scale) in both groups, with no predominance of one over the other immediately after therapy or at one month follow-up (p>.05).
OTHER THERAPEUTIC TECHNIQUES	Song et al. (2019), Korea	Cognitive orientation to daily occupational performance (CO-OP)	Task-specific training	4 weeks 5x a week 30 min/ session	N = 49 > 6 months	Only CO-OP treatment showed significant improvements (p<.05) in motor ability (WMFT-F, BBT) and task performance (COMP). Between-group comparison also revealed substantial difference (p<.05) in favor of CO-OP training.
	Ozen et al. (2021), Turkey	Computer game assisted task-specific training + usual physical therapy	RTP OT + usual physical therapy	4 weeks 5x a week 30 + 30 min/ sessions	N = 30 ≥ 3 months	Major improvements (p<.05) in UL function (FMA) and quality of life (SS-QOL) were accomplished in both groups. According to BSSR of the upper extremity significant change (p<.05) were observed in either group, but only the I.G. showed considerable progress (p=.024) of the hand.
	Yu et al. (2021), USA	Dynamic orthosis + TOT with dynamic orthosis	No treatment + TOT	6 weeks orthosis/ no treatment 6 weeks 12h TOT	N = 14 ≥ 6 months	Participants treated with a dynamic forearm rotation orthosis did not show greater change in functional performance of the UL (WFMT, MAL, COMP) than those who did not receive treatment. Moreover, combining a dynamic rotation orthosis with TOT, does seem not to enhance its therapeutic effect.

Note: Part.= Participants, Min.= Minutes, OT= Occupational Therapy, TOT= Task-Oriented Therapy, RTP= Repetitive Task Practice, BAT= Bilateral Arm Training, MT= Mirror Therapy, NDT= Neurodevelopmental Treatment I.G.= Intervention Group, C.G.= Control Group, AMAT= Arm Motor Activity Test, ARAT= Action Research Arm Test, BSSR= Brunnstrom stages of stroke recovery, BBT= Box and Block test, COMP= Canadian Occupational Performance Measure, FMA= Fugl-Meyer assessment, FTHUE= Functional Test for Hemiplegia Upper Extremity, MAL= Motor activity log (AOU= Amount of Use, QOM= Quality of Movement), MAS= modified Ashworth scale, MBI= modified Barthel index, MFT= Manual Function test, MVPT-V= Motor-Free Visual Perception Test-Vertical, RNSA= Revised Nottingham Sensation Assessment, SIS= Stroke impact scale, SS-QoL= stroke-specific Quality of Life, WMFT= Wolf Motor Function Test.

3.4.3 Mirror Therapy as a Task-Oriented Intervention

The effectiveness of integrating the task-oriented approach with mirror therapy was examined by two of the research groups included in this study (Bai et al., 2019; Li et al., 2019). Among these, Bai et al. (2019) established three intervention groups for comparison. Specifically, a task-oriented therapy program was assessed as a standalone intervention against two combined programs of task-oriented and mirror therapy, with the latter comprising either task-oriented or movement-based practice. This comparative analysis showed that all interventions resulted in significant progress ($p \leq 0.001$) in motor impairment and functionality, grip strength and hand spasticity, as well as occupational performance. However, the sequential use of movement-based mirror therapy and task-oriented therapy produced the greatest extent of improvement in motor impairment (between-group; $p \leq 0.05$) (Bai et al., 2019). Furthermore, the second study compared a combined program of home and clinic-based task-oriented mirror therapy with task-oriented bilateral training (Li et al., 2019). Similarly, the outcomes of the study conducted by Li et al. (2019) indicated that both mirror task-oriented therapy and task-oriented therapy as a standalone intervention did not differ statistically ($p=0.83$) in terms of their effectiveness on motor function. However, the results indicated that the combined use of mirror and task-oriented therapy tends to produce more substantial improvements in both quality and quantity of movement, as well as in temperature sensation of the hemiplegic upper limb (Li et al., 2019).

3.4.5 Task-Oriented Therapy Following Botulinum Toxin Injections

Two of the included studies were conducted to assess the effect of botulinum toxin (BoNT-A) injections in conjunction with a task-oriented therapy program. The study by Umar et al. (2018) compared two groups, each underwent a conventional task-oriented program, with one group additionally receiving BoNT-A injections in large muscle groups. On the other hand, Hung et al. (2022), compared three groups, all of which received BoNT-A injections in addition to task-oriented therapy, which was combined with one of the following: bilateral robot-assisted training, mirror therapy and bilateral arm training. Both studies demonstrated that all groups achieved significant progress in motor function, according to the FMA, and maintained comparable results at follow-up (Umar et al., 2018; Hung et al., 2022). The study by Hung et al. (2022) further indicated that, based on the Modified Ashworth Scale, all types of task-oriented therapy improved muscle tone to a similarly significant extent. While all therapy categories induced improvements on the MAL the task-oriented bilateral training showed statistically greater improvement ($p<0.05$) in quality of movement at 3-month follow-up compared to the other groups (Hung et al., 2022). Last but foremost, studies concluded that the efficacy of the task-oriented approach appears to be independent of the BoNT-A injections (Umar et al., 2018; Hung et al., 2022).

3.4.6 Integrating Task-Oriented Approach with other Therapeutic Techniques

This section categorizes studies that investigated combinations of task-oriented therapies not covered by the aforementioned categories, which are less frequently represented in the literature. Among these are therapeutic techniques, such as the use of cognitive strategies (Song et al., 2019), and assistive technologies, which include dynamic orthosis (Yu et al., 2021) and computer games (Ozen et al., 2021).

In the study by Song et al. (2019), the Cognitive Orientation to Daily Occupational Performance (CO-OP) was compared to the task-oriented approach. Although these two approaches share the same concept, CO-OP incorporates specific cognitive strategies to enhance performance. Two research groups practiced three self-selected, through the *COMP*, occupations according to each approach. Study results indicated that only the CO-OP approach led to statistically significant improvements ($p<0.05$) in functional ability, gross manual dexterity and occupational performance. Notably, the CO-OP approach demonstrated a superior effect ($p<0.05$) over the task-oriented approach. (Song et al., 2019)

Yu et al. (2021), employed a dynamic forearm orthosis to assist with pronation or supination, depending on activity and patient limitations, to support a task-oriented therapy program for individuals with chronic stroke. To determine whether orthosis would enhance the effectiveness of the task-oriented training, the researchers compared it to a control group that underwent the intervention program without the use of the orthosis. Study results confirmed the outcomes of a task-oriented approach previously reported by the forementioned included articles, including improvements ($p<0.05$) in self-perceived occupational performance, increase in amount of use and quality of movement of the affected limb. However, the orthosis did not seem to enhance ($p>0.05$) these therapeutic outcomes. (Yu et al., 2021)

Finally, Ozen et al. (2021) utilized a computer-based task-specific gaming system developed to enhance arm and hand coordination, dexterity and ADL performance. To assess its effectiveness in subacute-chronic stroke patients, the researchers compared an intervention group that underwent a task-oriented program with the computer system and a control group that received a conventional task-oriented program. The study revealed that both task-oriented interventions resulted in significant improvements ($p<0.05$) in *FMA* scores and in the *Brunnstrom Stages of Stroke Recovery (BSSR)* of the hemiplegic upper limb. The only notable difference between the groups was that the computerized task-oriented intervention also led to significant progress ($p=0.024$) in the *BSSR* specifically for the hand. (Ozen et al., 2021)

4. Discussion

The task-oriented approach emphasizes practicing real-life functional tasks as a method of rehabilitation, particularly after a stroke (Afridi et al., 2023). This approach is categorized as "top-down" (Preissner, 2010), as it focuses on the domains of Activity and Participation, as well as Environmental factors that hinder participation, rather than on the Body Functions and Structures outlined in the International Classification of Functioning, Disability and Health (ICF*)* (WHO, 2001; Brown & Chien, 2010).

Nevertheless, research indicates the effectiveness of this approach not only in improving ADL performance following a stroke but also in enhancing overall upper extremity function. In particular, this systematic review highlights evidence regarding spasticity (Bai et al., 2019; Hung et al., 2022), sensorimotor impairment (e.g., Page et al., 2020; Li et al., 2019; Ozen et al., 2021), and learned non-use of the affected extremity (Chen et al., 2022; Hsu et al., 2019; Yu et al., 2021), as well as ADL performance capacity (e.g., Alsubiheen et al., 2022; Choi, 2022; Pongtham et al., 2022).

Systematic reviews have highlighted research evidence supporting the effectiveness of the task-oriented approach in functional upper limb mobility and activities of daily living performance, with findings ranging from moderate to strong (Lee et al., 2024; Hildebrand et al., 2023). However, an earlier systematic review identified inconclusive results, drawing from four meta-analyses that reported minimal to moderate effect on ADL performance improvement (Lin et al., 2018).

Moreover, regarding combining therapeutic approaches, research suggests that utilizing complementary mechanisms of therapy facilitates optimal recovery following stroke (Afridi et al., 2023). However, this systematic review found mixed evidence supporting this notion, with outcomes varying depending on the specific modalities incorporated. Specifically, both robot-assisted and task-oriented therapy have been shown to promote upper limb motor function (Hsu et al., 2019; Chen et al., 2022; Page et al., 2020). Their incorporation may enhance therapeutic outcomes (Page et al., 2020; Lee et al., 2021). A previously conducted systematic review supports this for acute stroke patients. Conversely, for individuals with chronic stroke, combining task-oriented and robot-assisted therapy appears to be equally beneficial (Rozevink et al., 2023).

Similarly, the Bobath approach appears to promote upper extremity recovery across all stroke phases, to a degree comparable to task-oriented approach. However, the latter has been reported to lead to greater overall improvements (Moon et al., 2018; Firoozeh et al., 2019). Combining these two approaches does not appear to offer additional benefits beyond those of task-oriented therapy alone (Firoozeh et al., 2019). In addition, this review provides promising evidence that integrating mirror with task-oriented therapy enhances upper limb sensorimotor function and reduces hand hypertonia (Bai et al., 2019; Li et al., 2019). Finally, regarding BoNT-A injections as a priming intervention for task-oriented therapy, the efficacy of task-oriented therapy —whether applied alone or in combination— on motor function and focal hand dystonia may not be significantly influenced by botulinum toxin injections (Umar et al., 2018; Hung et al., 2022).

Despite the heterogeneity of the included studies —including variations in task-oriented intervention protocols, delivery methods, and participants' time since stroke — the findings of this systematic review highlight task-oriented therapy as a promising approach for upper extremity rehabilitation within occupational therapy after stroke. This aligns with the occupational therapy philosophy of incorporating functional and meaningful activities into practice (Pongtham et al., 2022; Lee et al., 2024). The variability in task-oriented interventions examined across studies may stem from the fact that this approach is a fundamental practice within occupational therapy, inherently adaptable and easily integrated with other therapeutic approaches.

Nevertheless, it is noteworthy that, in most studies, participants were in a later phase of stroke recovery (late subacute to chronic). This suggests that the task-oriented approach is more commonly implemented during advanced stages of rehabilitation. This may be attributed to the fact that performing daily activities requires more

advanced upper limb control, which tends to develop gradually throughout recovery.

4.1 Limitations and Future Research Directions

It is essential to acknowledge several potential limitations of this review. A key methodological limitation is the five-year publication restriction (2018–2023), which may have excluded relevant older studies. Additionally, article screening and data extraction were conducted by a single reviewer, which may limit methodological rigor. Furthermore, the majority of the articles included were conducted in Eastern countries, mainly Taiwan and Korea, which may limit the generalizability of the findings to different socioeconomic contexts. Although all studies investigated the effectiveness of task-oriented interventions, significant heterogeneity in intervention protocols and study methodologies made direct comparisons challenging. Lastly, this systematic review encompassed all phases of stroke (acute to chronic) without differentiating the effectiveness of the approach at different stages.

Future research should focus on standardizing intervention protocols to reduce variability in the approach when investigating the effectiveness of various task-oriented intervention modalities. Additionally, studies should investigate how different phases of stroke recovery influence the effectiveness of task-oriented interventions to determine the optimal timing for their application.

5. Conclusions

The findings of this review suggest that a range of task-oriented interventions have been applied to individuals at various stages of stroke recovery, showing promising results. These interventions demonstrate beneficial effects on upper limb function and occupational performance, particularly in patients with chronic stroke. Notably, integrating the task-oriented approach with other well-established occupational therapy methods is recognized as an effective strategy for rehabilitating the hemiplegic upper extremity post-stroke.

6. Authors' Contributions

Conceptualization: P.V., Data curation: A.T.; G.B., Formal Analysis: R.P., Funding Acquisition: P.V., Investigation: P.V.; R.P., Methodology: R.P.; P.V.; G.T., Project administration: P.V.; G.T., Resources: R.P., Software: R.P., Supervision: P.V., Validation: A.T.; I.G.K., Visualization: P.V., Writing- original draft: R.P.; P.V., Writing- review & editing: R.P. and P.V.

7. Conflicts of Interest

The authors declare that they have no conflict of interest.

8. Ethics Approval

Not applicable.

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