

# The Use of Tele-Occupational Therapy for Children and Adolescents with Different Disabilities: Systematic Review of RCT Articles

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## Abstract

**Background:** Due to the limited access of clients in non-urban areas to rehabilitation and the difficulty of specialized counseling in such conditions, the need for telehealth services has increased. The purpose of this study is to evaluate the effectiveness of Tele occupational therapy in common disorders of children and adolescents.

**Methods:** In this systematic review study, a research method published from 2010 to 2022 focusing on the effectiveness of tele-rehabilitation and its impact on children and adolescents with different physical disabilities was done in Google Scholar, PubMed, Scopus and EMBASE databases. 467 articles were obtained in the review, and finally, 18 articles were reviewed.

**Results:** In children with CP, Tele occupational therapy will be effective on gross motor function and balance skills, but the impact on the executive function needs more studies. In children with ASD, it will be effective on behavioral problems, but the effect on pro-social behavior needs further studies. In children and adolescents with other movement disorders, it will have an impact on the progress of their physical activity and in children and adolescents with Traumatic Brain Injury (TBI), it will be effective, but the effectiveness of MitiiTM programs needs further studies.

**Conclusion:** The findings of this study showed that tele-occupational therapy could be performed in line with face-to-face occupational therapy, and it can lead to the satisfaction of families, but there is still a need to assess the effectiveness of various interventions and tools on different disorders, outcomes and settings.

**Keywords:** Occupational Therapy, Telerehabilitation, Children, Cerebral Palsy, Autism Spectrum Disorder

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## Introduction

Telerehabilitation (TR) refers to the use of information technologies for remote support, assessment, and information to people with disabilities. TR refers to the provision of rehabilitation services using remote communication tools; in such a way that the client is at home or at work. Therefore, this model is a valuable clinical service

offering that includes assessment, treatment and follow-up services using telephone or other media like videos for remote monitoring (1). Over time, TR has been implemented by various and complex technologies to communicate with patients: including telephone, radio and closed-circuit television with video conferencing, and

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### ↑What is “already known” in this topic:

The use of telehealth has been proven in situations where people live in remote communities or in the country, have the possibility of having an infectious disease such as COVID-19, do not have access to specialist doctors, or need access to the services of several specialists.

### →What this article adds:

In case of unfavorable conditions where it is not possible to provide occupational therapy services in person, Tele occupational therapy can be a suitable and alternative method. In addition, Tele occupational therapy can be provided in addition to face-to-face occupational therapy to provide services at home.

nowadays Internet communication software (for example, Skype) with headsets, web Camera, speakers, handheld cameras, microphone and internet. It is expected that the advancement of technology will increase the usability of TR and thus improve services to clients (1). From 1995 to today, an increasing number of studies have been conducted on the TR of people with various disabilities. These studies have also focused on different types of TR such as Telehealth, telemedicine and Telerobotics and have shown that TR is an effective solution for providing rehabilitation services and improving the quality of life of clients. Research has also shown that TR improves the client's access to services and increases the efficiency of service delivery and facilitates access to specialized advice (2).

There are a variety of terms, including tele-occupational therapy, TR, Tele therapy, Tele care, Tele medicine and Tele practice for Tele occupational therapy services. Telehealth may be used by occupational therapists for assessment, intervention, supervision and consultation. Occupational therapy services through telehealth should be implemented according to individuals, groups, cultures, environment and the interests of the clients. In this method, like other interventions, there must be the consent of the client and the principle of confidentiality and professional ethics should be observed (3).

A child or adolescent is referred to occupational therapy when they have a specific disorder, such as Autism Spectrum Disorder (ASD) or Cerebral Palsy, or when they show a functional problem, such as poor fine motor skills or poor attention. The diagnosis or problem is the reason for providing treatment services, and in the meantime, occupational therapists always first see the child or adolescent with physical or mental disabilities as a unique person with their own desires, abilities, and disabilities and try to understand their interests, goals, and daily routines and include the preferred activities of the child and the family in their interventions (4).

The occupational therapy services provided through Telehealth can be synchronous, that is, through communication technologies, the intervention takes place at the same time as the service is provided, or it can be asynchronous, that is, by using technologies that facilitate the intervention process, they save it and then present it at another time (4, 5). Telehealth can be done in the places where the client does his activities, including living, working, learning and playing places. Occupational therapists use telehealth to help clients develop skills, make adjustments to their home, work, and school environments, and create routines and habits to promote health (5). Some benefits of telehealth include increasing access to different services and specialists, eliminating transportation between locations and thus reducing costs, eliminating social stigmas, preventing delays in the process of providing services for any reason, and comparison between specialists. It is through virtual consultations. Due to the difference in clients' factors, activity requests, performance skills, performance patterns, environments, etc., telehealth services must be tailored to each client. Factors that may affect the model and frequency of supervision of occupa-

tional therapists include the complexity of client's needs, the number and variety of clients, the skills of occupational therapists, the type of practice and the client's practice environment (5).

The emergence of COVID-19 caused a change in attitudes toward telehealth. In this era, the importance of this type of intervention became more obvious than before. According to the study by Tanner et al. (2020), families find these interventions acceptable and the patients' satisfaction rate showed high satisfaction and positive response of more than 98% in the use of teletherapy (6). Also, Faccioli et al. concluded in their study that during COVID-19, parents tended to have school support and healthcare professionals' consultations more remotely, which was available for most of the participants. Therefore, economic support, assistive technology, and remote rehabilitation strategies may also help families during shutdowns and any other disruptions (7).

Since the ultimate goal of occupational therapy is to promote the client's participation in life situations and the client's independence as much as possible in this field, and in case of any situation that leads to closure, such as the corona pandemic, providing rehabilitation services, especially occupational therapy. Also, clients should not be delayed, so the aim of this review study was to investigate the use of Tele occupational therapy for children and adolescents with different physical or mental disabilities.

## Methods

The systematic review process method (8) and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guidelines for systematic review studies (9) were used, respectively. Google Scholar, PubMed, OT seeker, Scopus and EMBASE databases were searched using the following keywords: Occupational Therapy, Tele Occupational Therapy, Tele Rehabilitation, Tele Therapy, Tele care, Occupational Therapies, Therapies, Occupational, Therapy, Occupational, Telemedicine, network, telecommunication, Tele Practice, Children and Adolescents. Moreover, for combining and defining the searched terms the Boolean operators "OR" and "AND" were also used, for example, "Tele Occupational Therapy OR Telemedicine".

## Inclusion and exclusion criteria

In this study, articles published in a peer-reviewed journal related to tele-occupational therapy and published in English from 2010 to 2022 were included. Articles that were at a level I of AOTA level of evidence were included in the study. AOTA levels of evidence; I (systematic reviews, meta-analyses, randomized controlled trials), level II (two-group, non-randomized studies [e.g., cohort, case-control]), level III (one-group, non-randomized [e.g., before and after, pre-test and post-test]), level IV (descriptive studies including analysis of results [single-subject design, case-control]) and level V (case report and expert opinion which includes narrative literature review and consensus statements) (10). Dissertations and presentations were excluded from the study. The aim of this study was to identify factors influencing TR, so articles found at

AOTA levels of evidence II, III, IV, V. were excluded.

Articles were searched between February 14, 2022, and March 18, 2022. Two researchers (the first author of the article and the second independent researcher) reviewed and screened the articles separately based on the title, abstract and finally the full text of the article. The first author and the second researcher independently found 467 articles. They screened the articles together again, and after removing duplicate articles, 241 articles remained. These articles were screened by the first and second authors based on the eligibility criteria. Articles were excluded because; they assessed TR in adults and the elderly (n=149), the fulltexts of the articles were not available (n=23), their language was different rather than English (n=31), and they were published before 2010 (n = 20). Finally, 18 articles remained and entered the final phase. The agreement rate of the researchers for the inclusion of these 18 articles was 90%. To assess the agreement rate between the two researchers, the third author screened the articles that met the eligibility criteria for this study. Any disagreements between researchers were resolved by discussion with the third author. Finally, the researchers extracted the data from the abstract and full text of 18 articles.

### Quality assessment of the studies

To evaluate the methodological quality of the studies, the Downs and Black scale, which included the parts of study quality, external validity, study bias and power, was used (11). In the present study, this scale was changed to 15 items because it was not possible to score some items due to the non-compliance of the items for the included studies. This scale evaluated the articles from 15 dimensions, and each dimension received one of the requirements, "No" (0 points), "Undetermined" (0 points) or "Yes" (1 point) and finally, the total score showed the quality of the present studies. The Downs and Black scales that evaluated the 18 mentioned studies are shown in Table 1.

Table 1. Quality assessment of the studies

Number of articles	Questions of Down and Black															Total Possible 15
	Q1	Q2	Q3	Q4	Q6	Q7	Q9	Q10	Q15	Q18	Q20	Q22	Q23	Q24	Q26	
1.	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	13
2.	1	1	1	1	1	0	1	0	1	1	1	1	0	1	1	12
3.	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	11
4.	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	11
5.	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	13
6.	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	12
7.	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	13
8.	1	1	0	1	1	1	1	0	1	1	1	0	0	1	1	11
9.	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	11
10.	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	13
11.	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	12
12.	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	13
13.	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	11
14.	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	13
15.	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	12
16.	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	12
17.	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	12
18.	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	12

Q:Question

### Data extraction

Author (year), title, type of study, randomization (type of randomization), participants/ diagnosis, intervention, Outcome measure (assessment), and result were extracted and are shown in Table 2.

### Results

Among the total of 467 articles, only 18 of them had inclusion criteria to be included in the study (Figure 1). All included studies were randomized clinical trial studies. Among the 18 study participants, 272 were individuals with CP, 179 were individuals with ASD, 152 were individuals with Traumatic Brain Injury (TBI), 16 were individuals with Pediatric-onset Multiple Sclerosis (POMS), 20 were individuals with ADHD, 22 were caregivers of children, and 65 individuals with other mobility disability. The ages of primary participants (children, and adolescents) ranged between 3 months and 18 years old.

The extracted data from the articles are presented in Table 1.

The quality of the scientific accuracy of the articles was 12 (median) out of 15 and ranged from 11 (low) to 13 (high). Among them, the overall quality of 7 articles was moderate (Total score of quality assessment=12), 6 articles were high (Total score of quality assessment>12), and 5 articles were poor (Total score of quality assessment<12) (Table 1).

### Discussion

Due to the conditions created by Covid-19 and quarantine, it was recommended to use and conduct more research on Tele occupational therapy. Although this type of intervention has been investigated in different disabilities, it is still suggested that its effect on different variables and areas be researched. In this regard, in a study in 2020, it was pointed out that more research is needed to better understand the characteristics of effective Tele occupational therapy and to determine that these characteristics are different in each population and for each outcome (30).

Table 2. Results of included articles

Author (year)	Title	Type of Study	Randomization* (type of randomization)	Participants/ diagnosis (N= /M: F/ age= To IG (n)/M:F/ Mean age $\pm$ SD, CG (n)/M:F/ Mean age $\pm$ SD)	Intervention (Intervention of IG/ Intervention of CG)	Outcome measure (assessment)	Result
1. Szturm, T., et al (2022) (12)	Game-Based Dual-Task Exercise Program for Children with Cerebral Palsy: Blending Balance, Visuomotor and Cognitive Training: Feasibility Randomized Control Trial	RCT: single-blind	+ (?)	N= 20 children with CP (N=20 / 14:6, 4-8 years old)  IG (n=10 / 7:3) 8.18 $\pm$ 2.32  CG (n=10/ 7:3/ 8.48 $\pm$ 2.84)	IG= respective therapy programs / novel game-based dual-task balance exercise program  CG= respective therapy programs	<ul style="list-style-type: none"> <li>• PBS</li> <li>• GMFM-88</li> <li>• MCTSIB</li> <li>And</li> <li>• computerized dual-task (DT) balance assessment</li> </ul>	A game-based DT balance training program for children with CP resulted in greater improvements in PBS, GMFM, and DT balance measures.
2. Jamale, AR., et al (2021) (13)	Randomized controlled trial of occupational performance coaching for families of children with autism spectrum disorder by means of telerehabilitation	RCT: single-blind	+ (Block)	N= 43 children with ASD (N=43 / 33:10, 4-12 years old)  IG(n=21 / 17:4) 8.18 $\pm$ 2.32  CG (n=22/ 16:6/8.48 $\pm$ 2.84)	IG= occupational performance coaching, which was delivered through telerehabilitation  CG= no Intervention	<ul style="list-style-type: none"> <li>• COPM</li> <li>• CAPES-DD</li> <li>• The Short-Form Health Survey, and</li> <li>• GAS</li> </ul>	Occupational performance coaching based on telerehabilitation was effective on occupational performance and self-efficacy of parents with ASD, but it was not effective on children's abnormal behaviors and improvement of parents' quality of life after the follow-up stage.
3. Jarvis, J m., et al (2020) (14)	Electronic participation-focused care planning support for families: a pilot study	CT: a pilot study	-	N= 22 caregivers of children 0-5 years old receiving rehabilitation (N=22 / 5:17, 21-49 years old)	IG= PEM+ 2.0	<ul style="list-style-type: none"> <li>• PEM-CY</li> <li>• PRO- e</li> </ul>	Electronic health tools have the potential to facilitate family-centered care in pediatric rehabilitation. The PEM-CY is a viable tool in pediatric rehabilitation and has the potential to be an acceptable tool to improve caregiver confidence to promote their child's participation in valued activities.

RCT; Randomized Control Trial; N: Number; M: Male; F: Female; CG: Control Group; IG: Intervention Group

Table 2. Continued

Author (year)	Title	Type of Study	Randomization* (type of randomization)	Participants/ diagnosis (N= /M: F/ age= To , IG (n)/M:F/ Mean age $\pm$ SD, CG (n)/M:F/ Mean age $\pm$ SD)	Intervention (Intervention of IG/ Intervention of CG)	Outcome measure (assessment)	Result
4. Wingo, B C., et al. (2020) (15)	Lessons learned from a blended telephone/e-health platform for caregivers in promoting physical activity and nutrition in children with a mobility disability	RCT: pilot study	+ (?)	N= 65 Parent/ children with a mobility disability (N=65 / 6-17 years old)  50 Parents: IG(n=24 / 3:21) CG (n=26/ 2:24)  50 Children: IG(n=24 / 9:15) 11.7 $\pm$ 3.1 CG (n=26/ 12:14) 10.9 $\pm$ 3.6	IG=regular calls from a telecoach and access to a website with personalized weekly goals for diet and physical activity, and access to resources to meet these goals  CG=regular calls from a telecoach	<ul style="list-style-type: none"> <li>• Height and Weight</li> <li>• Dietary Patterns</li> <li>• Physical Activity</li> <li>• wall-mounted stadiometer</li> <li>• food frequency questionnaire</li> <li>• physical activity questionnaire</li> </ul>	In this study, due to the lack of ease of use of E-health, no significant difference in dietary intake or physical activity was observed within or between the intervention and control groups. E-health interventions appear to be a promising way to promote healthy behaviors in children with physical disabilities, but technology must be balanced with ease of use for parents while also engaging the child.
5. Lindgren, S., et al (2020) (16)	A Randomized Controlled Trial of Functional Communication Training via Telehealth for Young Children with Autism Spectrum Disorder	RCT	+ (?)	N= 38 young children with ASD (N= 38 / 32:6, 21–84 months)  IG(n=21 / 18:3) 49.71 $\pm$ 16.97  CG (n=17 / 14:3 / 55.29 $\pm$ 17.01)	IG= functional communication training (FCT)  CG= treatment as usual	<ul style="list-style-type: none"> <li>• Mullen Scales of Early Learning</li> <li>• And</li> <li>• VABS—Second Edition (Vineland-II)</li> </ul>	FCT treatment based on telehealth through parent-administered reduced problem behaviors, improved social communication, and task completion in children with ASD.
6. Surana, B K., et al (2019) (17)	Effectiveness of Lower-Extremity Functional Training (LIFT) in Young Children With Unilateral Spastic Cerebral Palsy: A Randomized Controlled Trial	RCT	+ (?)	N= 24 children with Unilateral Spastic CP (N=24 / 10:14)  IG(n=12 / 5:7) 5.8 $\pm$ 2.3  CG (n=12/ 5:7) 5.1 $\pm$ 2.6	IG= LE intensive functional training (LIFT)  CG= upper-extremity bimanual training (Hand-Arm Bimanual Intensive Therapy [H-HABIT])	<ul style="list-style-type: none"> <li>• IMWT</li> <li>• ABILOCO-kids</li> </ul>	Carrying out intensive LE interventions in the home environment by caregivers is an effective and new delivery method to improve walking capacity and performance. LIFT delivered in the home environment using remote rehabilitation results in improved walking distance, improved overall walking ability, and increased social interaction and attention between caregiver and child.
7. Parsons, D., et al. (2019) (18)	A Randomised Controlled Trial of an Information Communication Technology Delivered Intervention for Children with Autism Spectrum Disorder Living in Regional Australia	RCT: single-site trial	+ (Block)	N= 59 children with ASD (N=59 / 48:11, 2-6 years old)  IG(n=30 / 25:5) 64.4 $\pm$ 22.73  CG (n=29/ 23:6/ 60.8 $\pm$ 15.47)	IG= tablet-based information communication technology early intervention application  CG= therapy-as-usual	<ul style="list-style-type: none"> <li>• Mullen Scales of Early Learning</li> <li>• Communication and Symbolic Behavior Scales</li> </ul>	Tele health interventions lead to improvements in receptive and pragmatic language and social skills in children with ASD. These gains were retained, thus demonstrating skill acquisition.



Table 2. Continued

Author (year)	Title	Type of Study	Randomization* (type of randomization)	Participants/ diagnosis (N= /M: F/ age= To , IG (n)/M:F/ Mean age $\pm$ SD, CG (n)/M:F/ Mean age $\pm$ SD)	Intervention (Intervention of IG/ Intervention of CG)	Outcome measure (assessment)	Result
8. Cox, N S., et al. (2019) (19)	A web-based intervention to promote physical activity in adolescents and young adults with cystic fibrosis: protocol for a randomized controlled trial	RCT: single-blind	+ (Block)	?	IG= standardized information regarding general physical activity recommendations for adolescents and young adults / web-based physical activity platform  CG= standardized information regarding general physical activity recommendations for adolescents and young adults	• MVPA	A web-based program can improve physical activity participation in people with CF more effectively than usual care in the post-hospitalization period for respiratory exacerbations.
9. Corti, C., et al (2018) (20)	Feasibility of a home-based computerized cognitive training for pediatric patients with congenital or acquired brain damage: An explorative study	RCT: single-center	+ (?)	N= 32 adolescents with a diagnosis of congenital or acquired (TBI non-TBI) (N=32 / 19:13, 11-16 years old) 13.5 $\pm$ 1.6	IG= Lumosity Cognitive Training	• LPI	Telerehabilitation for adolescents with brain injury is practical and applicable, even if programs are not available in the mother tongue, a training program in a foreign language can be used.
10 Simone, M., et al (2018) (21)	Computer-assisted rehabilitation of attention in pediatric multiple sclerosis and ADHD patients: a pilot trial	RCT: pilot double-blind RCT	+ (parallel group double blind-RCT)	N= 16 POMS and 20 ADHD patients (N=36/ 33:10, 4-12 years old) POMS: IG(n=8 / 3:5) 15.8 $\pm$ 2.0 CG (n=8 / 4:4 / 15.7 $\pm$ 1.5) ADHD: IG(n=10 / 10:0) 11.5 $\pm$ 3.0 CG(n=10 / 8:2 / 11.3 $\pm$ 2.0)	IG= cognitive training  CG= no intervention	• CII	Brain-based cognitive telerehabilitation programs are a suitable tool for improving global cognitive performance in POMS patients, while it has less effect in ADHD patients and has a greater effect only on the cognitive test of attention exploration and delayed recall of visual-spatial memory functions.
11 Bearss, K., et al. (2018) (22)	Feasibility of Parent Training via Telehealth for Children with Autism Spectrum Disorder and Disruptive Behavior: A Demonstration Pilot	CT: pilot trial	0	N= 14 children with ASD (N=14 / 9:5, 3-7 years, 11 months)  5.8 $\pm$ 1.7	IG= RUBI-PT program delivered via telehealth	• TFC • PTAS • ABC • HSQ-ASD • PTP • CGI-I • VABS Second Edition, Parent Interview Format (VABS-II)	Parent education via telehealth was acceptable to parents and treatment could be reliably delivered by therapists.

Table 2. Continued

Author (year)	Title	Type of Study	Randomization* (type of randomization)	Participants/ diagnosis (N= /M: F/ age= To , IG (n)/M:F/ Mean age $\pm$ SD, CG (n)/M:F/ Mean age $\pm$ SD)	Intervention (Intervention of IG/ Intervention of CG)	Outcome measure (assessment)	Result
12. Ferre, C L., et al (2017) (23)	Caregiver-directed home-based intensive bimanual training in young children with unilateral spastic cerebral palsy: a randomized trial	RCT: single blind	+	N= 24 children with young children with unilateral spastic cerebral palsy (N=24 / 10:14, 2y 6mo–10y 1mo) IG(n=12 / 5:7) 5.2 $\pm$ 2.7 CG (n=12/ 5:7/ 5.8 $\pm$ 2.3)	IG= home-based hand-arm bimanual intensive therapy  CG= lower-limb functional intensive training	<ul style="list-style-type: none"> <li>• BBT</li> <li>• AHA</li> <li>• COPM</li> </ul>	Home treatments based on telerehabilitation can be used as a valuable and family-oriented approach to achieve increased treatment intensity, such as CIMT, and H-HABIT.
13. Comans, T., et al (2017) (24)	The cost-effectiveness of a web-based multimodal therapy for unilateral cerebral palsy: the Mitii randomized controlled trial	RCT	+	N= 102 children with unilateral cerebral palsy (N=102 / 52:50)  Children: IG(n=36 / 26:0) 10.1 $\pm$ 1.4 CG(n=33 / 26:0/ 9.8 $\pm$ 1.3)  Adolescents: IG(n=15 / 26:0) 14.2 $\pm$ 1.3 CG(n=18 / 26:0/ 14.3 $\pm$ 1.3)	IG= Mitii training  CG= program to usual care	<ul style="list-style-type: none"> <li>• AMPS</li> <li>• COPM</li> </ul>	Providing telerehabilitation services can be cost-benefit in that the cost of providing the Mitii™, training system is very low compared to the performance improvement.
14. Sgandurra, G., et al (2017) (25)	A randomized clinical trial in preterm infants on the effects of a home-based early intervention with the 'CareToy System'	Randomized Controlled Trial: single-blind	+	N= 41 preterm infants (N=41 / 19:22, 3:0-5:9 months) IG(n=19 / 8:11) 30.7 $\pm$ 1.4 CG (n=22/ 11:11/ 30.82 $\pm$ 1.1)	IG= CareToy program  CG= Standard Care	<ul style="list-style-type: none"> <li>• IMP</li> </ul>	CareToy system can provide effective home based intervention to infants as a telerehabilitation program.
15. Piovesana, AM., et al (2017) (26)	Randomized controlled trial of a web-based multimodal therapy program for executive functioning in children and adolescents with unilateral cerebral palsy	RCT	+	N= 102 children and adolescents with unilateral cerebral palsy (N=101 / 51:50, 8–18 years old)  IG(n=51 / 26:25) 11.63 $\pm$ 2.30  CG (n=50/ 25:25 11.86 $\pm$ 2.45)	IG= immediate intervention (Mitii™)  CG= standard care	<ul style="list-style-type: none"> <li>• FSIQ</li> <li>• WISC-IV-SF</li> <li>• D-KEFS</li> <li>• BRIEF</li> <li>• DSB</li> <li>• NLS</li> <li>• TMT</li> </ul>	The results indicated that in the long-term use of programs based on telerehabilitation such as Mitii™, parental satisfaction decreases. As in the present study, there was no significant difference between the groups in attention control, cognitive flexibility (inhibition, order of numbers/letters, problem solving, information processing, coding) and the level of family satisfaction with telerehabilitation services was low.

Table 2. Continued

Author (year)	Title	Type of Study	Randomization* (type of randomization)	Participants/ diagnosis (N= /M: F/ age= To , IG (n)/M:F/ Mean age $\pm$ SD, CG (n)/M:F/ Mean age $\pm$ SD)	Intervention (Intervention of IG/ Intervention of CG)	Outcome measure (assessment)	Result
16. Baque, E., et al (2017) (27)	Randomized controlled trial of web-based multi-modal therapy for children with acquired brain injury to improve gross motor capacity and performance	RCT	+	N= 60 independently ambulant children (N=60)  IG (n=30)  CG (n=30)  58 children completed baseline assessments (32 males; age 11 years 11 months $\pm$ 2 years 6 months)	IG= The Mitii™ program comprised of gross motor, upper limb and visual perception/cognitive activities  CG= usual care	(30-second repetition maximum functional strength tests for the lower limb)	The use of the Mitii™, program showed significant results in lower extremity functional strength tests based on statistical analyses, but as the results did not exceed minimal detectable change, they cannot be considered clinically relevant for children with acquired brain injury.
17. Piovesana, A., et al (2017) (28)	A randomized controlled trial of a web-based multi-modal therapy program to improve executive functioning in children and adolescents with acquired brain injury	RCT	+	N= 60 children with an ABI (N=60)  IG(n=30) CG (n=30 / 17:13) mean age=11y, 11m ( $\pm$ 2y, 6m)  Fifty-eight children (32 males; mean age=11.87 $\pm$ 2.47)	IG= Mitii™ training  CG= Care As Usual	<ul style="list-style-type: none"> <li>• WISC-IV</li> <li>• D-KEFS</li> <li>• CTMT</li> <li>• TOL</li> <li>• Tea-Ch</li> </ul>	The results show that there is no additional benefit to receiving Mitii™ services compared to standard and routine care. Mitii™, in its current form, does not improve EF in children with ABI.
18. Palsbo, SE., et al (2011) (29).	Towards a modified consumer haptic device for robotic-assisted fine-motor repetitive motion training	CT: pilot study	0	N= 21 healthy volunteers (N=21, children entering grades 1 to 6)	IG= Handwriting Without Tears TM (HWT) curriculum (manuscript only)	<ul style="list-style-type: none"> <li>• ETCH</li> <li>• VMI</li> <li>• BAMF</li> </ul>	The use of devices similar to robots, such as pantograph, can be used to teach repetitive movements. These devices are safe, affordable, portable, and attractive to healthy individuals, and offer the possibility of telerehabilitation between a therapist and a client in school or home.



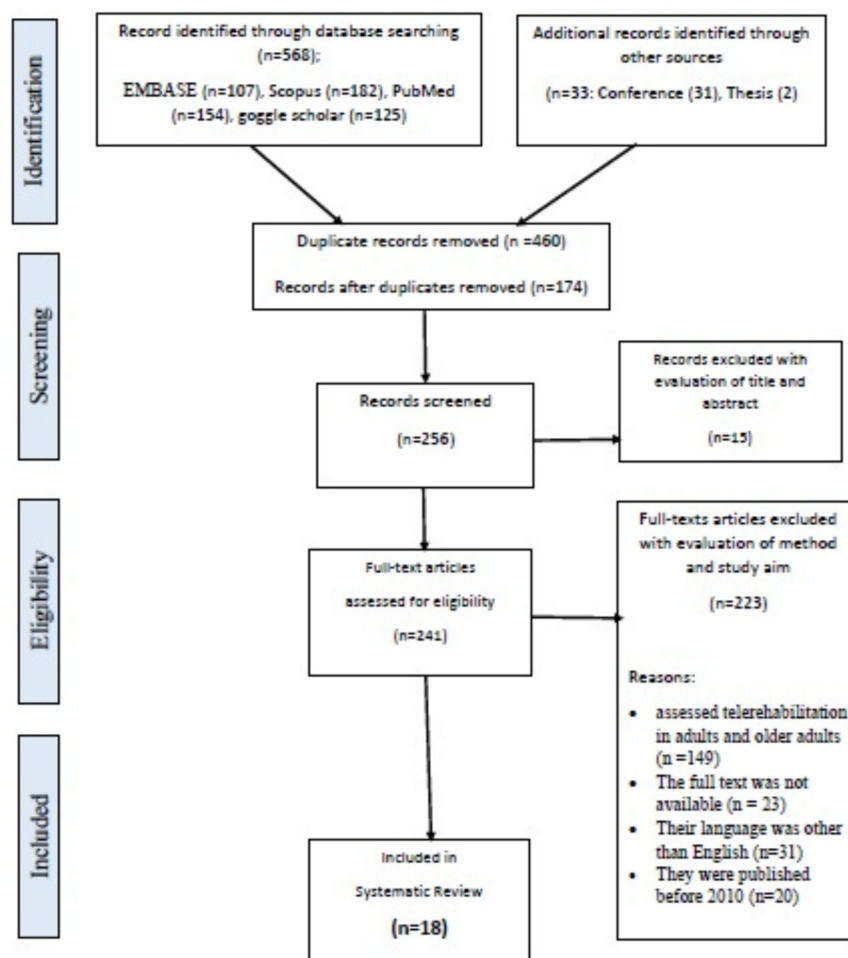


Figure 1. PRISMA flow diagram

In the current study, among the 18 articles found, 5 articles are related to children or adolescents with CP, 4 articles were related to children or adolescents with ASD, 3 articles were related to children or adolescents with other movement disorders, 3 articles were related to children or adolescent with TBI, 1 article was related to children or adolescent with ADHD 1 article was related to children's caregivers and 1 article was related to POMS.

#### Tele Occupational Therapy in children or adolescents with CP

Among the 5 study articles related to children or adolescent CP, Szturn T., et al. (2022) reported positive results and high satisfaction from a Game-Based Dual-Task Exercise Program conducted online. In their study, which was conducted on 20 children aged 4 to 8 years with CP, the results indicated a positive effect of the Game-Based Dual-Task Exercise Program online, which was conducted for 12 sessions (3 sessions per week) on motor performance. It was large for children and also balanced for children (12). In addition, Surana, BK., et al. (2019) also found improvements in mobility in Lower-Extremity In-

tensive Functional Training (LIFT), which was performed as TR for 9 weeks (5 days per week, each two-hour session) on 24 children with CP. and in general, the walking of children with CP reported, in addition, they stated that if the LIFT program, which is carried out as TR, if it is included as an application program in children's rehabilitation programs, it can have positive effects in addition to Children's gross motor performance, but also effective in improving the social relationship between the caregiver and the child (17). In a study, Ferre, CL., et al. (2017) examined Caregiver-directed home-based intensive bi-manual training, which was carried out as TR for 9 weeks (5 days per week, each session lasting two hours) on 24 children with CP, based on the results of the study, children with CP who received the program reported improvements in dexterity and caregivers' satisfaction with the child's progress(23). In their study, Comans, T., et al. (2017) investigated the effect of a web-based multimodal therapy program (Mitii training) on 102 children and adolescents with CP for 20 weeks. They used TR programs such as Mitii training to improve motor skills and showed satisfaction with the performance. Moreover, they showed

that such programs lead to a reduction in rehabilitation costs and can be referred to as a cost-benefit program (24). Piovesana, AM., et al. (2017) also discussed the impact of the multimodal therapy program (Mitii™) on the executive performance of 102 children and adolescents with CP and stated that in a larger sample size study, Mitii™ did not result in significant improvements in EF or parent ratings of EF performance in children with UCP (28).

According to the present studies, it can be said that the use of TR programs in children and adolescents with CP, if it is planned to improve children's movement and balance, will be effective and will bring satisfaction to the families of these children too. But the impact of TR programs on the executive performance of these children needs to be investigated and more serious studies.

#### **Tele Occupational Therapy in children or adolescents with ASD**

Among the 4 articles from the study that were related to ASD, Jamali, AR., et al. (2022) conducted occupational performance coaching on 43 children with ASD through virtual rehabilitation and reported improvements in occupational performance, specific goals, and behavioral problems of these children (13). Lindgren, S., et al. (2020) performed Functional Communication Training on 38 children with ASD virtually, and they also reported that the behavioral problems of these children decreased by 98% in their study, but no improvement was seen in the prosaic behavior. Also, the improvement in the quality of life of parents' did not remain in the follow-up phase. Occupation performance coaching through virtual rehabilitation is effective in occupational performance and parental self-efficacy of ASD children, but no effect was seen in the prosaic behaviors of these children (16). Parsons, D., et al. (2019) conducted their investigations on 59 children with ASD and in their intervention, they used tablet-based information communication technology. They used early intervention application. They are also improvements in receptive and pragmatic language and social showed skills and these improvements were maintained (18). Also, Bearss, K., et al. (2018) conducted the RUBI-PT program on 14 children with ASD via telehealth and reported that in their study, 11 of the 14 participants showed great and very great improvements behaviorally (22).

According to the present studies, it can be said that the use of TR programs in children with ASD, if it is planned to improve children's behavioral problems, will be effective and will bring satisfaction to the families of these children, but the effectiveness of the program TR needs more studies on the pro-social behavior of these children.

#### **Tele Occupational Therapy in children or adolescents with other mobility disabilities**

Wingo, BC., et al. (2020) examined 65 Parents/children with a mobility disability coaching and personalized web-site and reported that E-health interventions are a promising method to promote health behaviors in children with physical disabilities, but the expression said that technology should be balanced with ease of use for parents (15). Cox, NS., et al. (2019) used a web-based physical activity

platform and they also used web-based interventions in the development of adolescents and young with physical activity, and they consider it effective in the adolescent with cystic fibrosis (19). Sgandurra, G., et al. (2017) investigated 41 premature infants and used the CareToy program in their study. They also stated that in premature infants CareToy system could provide effective home-based EI in order to improve the motor activity of babies (25).

According to the present studies, it can be said that the use of TR programs in children and adolescents with movement disorders, if it is done using web-based interventions, will have an impact on the progress of their physical activity and the satisfaction of the families of these children.

#### **Tele Occupational Therapy in children or adolescents with TBI**

Among the 3 articles of the study that were related to TBI, Corti, C., et al. (2018) conducted Lumosity Cognitive Training on 32 teenagers with congenital or acquired TBI and they also stated that virtual rehabilitation to It is considered a feasible exercise for teenagers with TBI and it improves their functional tasks (20). Baque, E., et al. (2017) examined the Mitii™, program on 60 independently ambulant children with TBI and stated that although the use of the Mitii™, program showed significant results in lower extremity functional strength tests based on statistical analyses, the results did not exceed minimal detectable change (27). Piovesana, AM., et al. (2017) also investigated the Mitii™ program in 60 children with acquired TBI and did not show improvement in these people too (28).

According to the present studies, it can be said that the use of TR programs in children and adolescents with TBI, if planned to improve functional tasks, will be effective and bring satisfaction to the families of these children. But the effectiveness of Mitii™, programs needs more serious studies.

#### **Tele Occupational Therapy in children or adolescents with POMS and ADHD**

Simone, M., et al. (2018) investigated cognitive training on 16 Children with POMS and 20 children with ADHD and stated that a computer-assisted cognitive rehabilitation program that targets attention is a suitable tool for improving cognitive performance in POMS children, but in ADHD It has less impact (21).

#### **Tele Occupational Therapy in Families or parents of children or adolescents with different disabilities**

Jarvis JM., et al. (2020) conducted their study on 22 caregivers of 0-5 year-old children receiving rehabilitation and reported that electronic interventions are a possible tool in the rehabilitation of children and improve the caregiver's self-confidence to promote the child's participation in activities (14).

#### **Conclusion**

The findings of this study showed that Tele occupation-

al therapy could be performed in line with face-to-face occupational therapy, and it can lead to the satisfaction of families; but there is still a need to investigate the effectiveness of various interventions and tools on different disorders, outcomes and settings.

### Limitation

In the present study, due to the fact that the authors of the study also played a role in searching for articles and selecting studies, as well as evaluating the overall quality of the articles, there was a possibility of bias in the mentioned cases. Therefore, it is suggested that in future studies, people outside the research team should be used not only in searching for articles but also in evaluating the quality of the articles entered, and at least two people should perform the actions independently in each field.

### Authors contributions

S.D. and M.P. conceived of the presented idea. S.D. developed the theory. N.M. and S.D. wrote the first draft of the manuscript. B.C. and M.P. supervised the this work and edited the final version of the manuscript.

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### Conflict of Interests

The authors declare that they have no competing interests.

### References

- Kumar S, Cohn ER, editors. Telerehabilitation. Springer Science & Business Media; 2012 Oct 28.
- Capri T, Nucita A, Iannizzotto G, Stasolla F, Romano A, Semino M, et al. Telerehabilitation for improving adaptive skills of children and young adults with multiple disabilities: a systematic review. *Rev J Autism Dev Disord*. 2021 Jun;8(2):244-52.
- World Federation of Occupational Therapists. World Federation of Occupational Therapists' position statement on telehealth. *International journal of telerehabilitation*. 2014;6(1):37.
- Farajzadeh A, Amini M, Maroufizadeh S, Wijesinghe CJ. Caregiver Difficulties Scale (CDS): Translation and Psychometric Evaluation Among Iranian Mothers of Cerebral Palsy Children. *Occup Ther Health Care*. 2018;32(1):28-43.
- Telehealth in Occupational Therapy. *Am J Occup Ther*. 2018;72(Supplement 2):7212410059p1-7212410059p18.
- Tanner K, Bican R, Boster J, Christensen C, Coffman C, Fallieras K, et al. Feasibility and acceptability of clinical pediatric telerehabilitation services. *Int J Telerehabil*. 2020;12(2):43.
- Faccioli S, Lombardi F, Bellini P, Costi S, Sassi S, Pesci MC. How did Italian adolescents with disability and parents deal with the COVID-19 emergency?. *Int J Environ Res Public Health*. 2021 Feb;18(4):1687.
- Law MC, MacDermid J, editors. Evidence-based rehabilitation: A guide to practice. Slack Incorporated; 2008.
- Moher D, Liberati A, Tetzlaff J, Altman DG, Group TP. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):e1000097-6.
- Tomlin G, Borgetto B. Research pyramid: A new evidence-based practice model for occupational therapy. *Am J Occup Ther*. 2011 Mar;65(2):189-96.
- Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *J Epidemiol Community Health*. 1998 Jun 1;52(6):377-84.
- Szturm T, Parmar ST, Mehta K, Shetty DR, Kanitkar A, Eskicioglu R, et al. Game-Based Dual-Task Exercise Program for Children with Cerebral Palsy: Blending Balance, Visuomotor and Cognitive Training: Feasibility Randomized Control Trial. *Sensors (Basel)*. 2022 Jan 19;22(3):761.
- Jamali AR, Alizadeh Zarei M, Sanjari MA, AkbarFahimi M, Saneii SH. Randomized controlled trial of occupation performance coaching for families of children with autism spectrum disorder by means of telerehabilitation. *Br J Occup Ther*. 2022 May;85(5):308-15.
- Jarvis JM, Kaelin VC, Anaby D, Teplicky R, Khetani MA. Electronic participation-focused care planning support for families: a pilot study. *Dev Med Child Neurol*. 2020 Aug;62(8):954-61.
- Wingo BC, Yang D, Davis D, Padalabalanarayanan S, Hopson B, Thirumalai M, et al. Lessons learned from a blended telephone/e-health platform for caregivers in promoting physical activity and nutrition in children with a mobility disability. *Disabil Health J*. 2020 Jan 1;13(1):100826.
- Lindgren S, Wacker D, Schieltz K, Suess A, Pelzel K, Kopelman T, et al. A randomized controlled trial of functional communication training via telehealth for young children with autism spectrum disorder. *J Autism Dev Disord*. 2020 Dec;50(12):4449-62.
- Surana BK, Ferre CL, Dew AP, Brandao M, Gordon AM, Moreau NG. Effectiveness of lower-extremity functional training (LIFT) in young children with unilateral spastic cerebral palsy: A randomized controlled trial. *Neurorehabil Neural Repair*. 2019 Oct;33(10):862-72.
- Parsons D, Cordier R, Lee H, Falkmer T, Vaz S. A randomised controlled trial of an information communication technology delivered intervention for children with autism spectrum disorder living in regional Australia. *J Autism Dev Disord*. 2019 Feb;49(2):569-81.
- Cox NS, Eldridge B, Rawlings S, Dreger J, Corda J, Hauser J, et al. A web-based intervention to promote physical activity in adolescents and young adults with cystic fibrosis: protocol for a randomized controlled trial. *BMC Pulm Med*. 2019 Dec;19(1):1-8.
- Corti C, Poggi G, Romaniello R, Strazzer S, Urgesi C, Borgatti R, et al. Feasibility of a home-based computerized cognitive training for pediatric patients with congenital or acquired brain damage: An explorative study. *PLoS One*. 2018 Jun 20;13(6):e0199001.
- Simone M, Viterbo RG, Margari L, Iaffaldano P. Computer-assisted rehabilitation of attention in pediatric multiple sclerosis and ADHD patients: a pilot trial. *BMC Neurol*. 2018 Dec;18(1):1-1.
- Bearss K, Burrell TL, Challa SA, Postorino V, Gillespie SE, Crooks C, et al. Feasibility of parent training via telehealth for children with autism spectrum disorder and disruptive behavior: A demonstration pilot. *J Autism Dev Disord*. 2018 Apr;48(4):1020-30.
- Ferre CL, Brandão M, Surana B, Dew AP, Moreau NG, Gordon AM. Caregiver-directed home-based intensive bimanual training in young children with unilateral spastic cerebral palsy: a randomized trial. *Dev Med Child Neurol*. 2017 May;59(5):497-504.
- Comans T, Mihala G, Sakzewski L, Boyd RN, Scuffham P. The cost-effectiveness of a web-based multimodal therapy for unilateral cerebral palsy: the Mitii randomized controlled trial. *Dev Med Child Neurol*. 2017 Jul;59(7):756-61.
- Sgandurra G, Lorentzen J, Inguaggiato E, Bartalena L, Beani E, Cecchi F, et al. A randomized clinical trial in preterm infants on the effects of a home-based early intervention with the 'CareToy System'. *PLoS ONE*. 2017 Mar 22;12(3):e0173521.
- Piovesana MA, Ross S, Lloyd O, Whittingham K, Ziviani J, Ware RS, et al. Randomized controlled trial of a web-based multi-modal therapy program for executive functioning in children and adolescents with unilateral cerebral palsy. *Disabil Rehabil*. 2017 Sep 25;39(20):2021-8.
- Baque E, Barber L, Sakzewski L, Boyd RN. Randomized controlled trial of web-based multimodal therapy for children with acquired brain injury to improve gross motor capacity and performance. *Clin Rehabil*. 2017;31(6):722-732. doi:10.1177/0269215516651980
- Piovesana A, Ross S, Lloyd O, Whittingham K, Ziviani J, Ware RS, et al. A randomised controlled trial of a web-based multi-modal therapy program to improve executive functioning in children and adolescents with acquired brain injury. *Clin Rehabil*. 2017 Oct;31(10):1351-63.
- Palsbo SE, Marr D, Streng T, Bay BK, Norblad AW. Towards a modified consumer haptic device for robotic-assisted fine-motor repetitive motion training. *Disabil Rehabil Assist Technol*. 2011 Nov 1;6(6):546-51.
- Camden C, Pratte G, Fallon F, Couture M, Berbari J, Tousignant M.

Diversity of practices in telerehabilitation for children with disabilities and effective intervention characteristics: results from a systematic review. *Disabil Rehabil.* 2020 Nov 19;42(24):3424-36.