SYSTEMATIC REVIEW

Role of tele-rehabilitation in patients following total hip replacement: Systematic review of clinical trials

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Abstract

Objective: Tele-rehabilitation to explore current evidence on the effectiveness of tele-rehabilitation compared to face-to-face rehabilitation for patients after total hip replacement.

Method: The systematic review of clinical trials comprised search of Cochrane, Medline, Embase and PEDro databases from 2000 to date for English-language, human studies dealing with postoperative rehabilitation of total hip replacement patients. A thorough search was performed to retrieve articles missed through databases as well as unpublished grey literature. Methodological quality assessment was done using the Cochrane risk of bias tool, and the studies were critically appraised using the PEDro scale.

Results: Of the 150 studies initially found on the databases, 11(7.3%) were subjected to detailed review; 4(36.4%) randomised trials, 3(27.3%) randomised controlled protocols, 3(27%) randomised pilot studies, and 1(9%) prospective cohort study. Overall, 8(72.7%) studies were of 'high' quality and 3(27.3%) fell under the category of 'fair'.

Conclusion: Tele-rehabilitation group reported similar improvement in terms of activities of daily living and quality of life as did those exposed to traditional rehabilitation.

Keywords: Remote rehabilitation, Tele-rehabilitation, Total hip arthroplasty. (JPMA 72: 101; 2022)

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Introduction

Total hip arthroplasty (THA) is known to be the gold standard management due to severe osteoarthritis of hip. An increasing trend has been seen for such procedures over the previous decade, with almost 40,000 performed in Australia and 85,000 in the United Kingdom.[1] In Pakistan, a substantial increase in hip replacement would be expected in the decades ahead due to demographic trends.[2] Enhancing postoperative care for total hip replacement (THR) through early rehabilitation programmes has proved to be effective. Rehabilitation is considered a vital aspect of treatment strategy post–THR and it results in the improvement in terms of functional activities as well as pain reduction.[3]

THR effectiveness is well recognised and documented. Rehabilitation is considered a key factor to optimise clinical outcomes. Moreover, literature highlights that intensive and timely progressive rehabilitation exercise leads to optimal outcomes, higher satisfaction rates, greater adherence and reduced complications plus cost.[4] In a specialist panel consensus on finest practices for rehabilitation following hip arthroplasty, the utmost support was for therapeutic exercise for 1-2 months, twice or thrice a week.[5]

The expanding accessibility of minimal-cost internet technology and corresponding innovations has provided the opportunity for administration of innovation-based answers and to deliver health-related services during hospitalisation as well as after discharge. Tele-rehabilitation is classified as one of the promising sub-domain of telemedicine and is characterised as a set of devices, methodology and strategies to deliver rehabilitation services in remote areas.[6]

Tele-rehabilitation is emerging as an alternative to traditional face-to-face rehabilitation in home-care. It includes the use of multiple information technologie (IT) services to deliver rehabilitation care for individuals living in remote areas. Such services have a wide array, like assessment, examination, evaluation, intervention, follow-up, consultation and counselling.[7]

The utilisation of tele-rehabilitation ensured the delivery of rehabilitation services directly to the patients' homes. Access issues of patients living in rural and urban areas can be addressed through this significant method. Majority of hip replacement patients face difficulty in accessing health services post-discharge. Seeking rehabilitation services add economic burden to the patient. The factors of time and travelling cost further exaggerate the problems.[8]

Tele-rehabilitation by means of tele-communication services includes the provision of several rehabilitation

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facilities, like physical therapy (PT). Cost-effectiveness and physical unavailability of the therapist are one of the key benefits of tele-rehabilitation compared to the traditional care. These advantages are significant, particularly for patients residing in distant locations or not able to reach the health providers due to physical limitations. Moreover, this mode of delivery has the potential to discourage pointless hospital admissions and interruptions in hospital discharge.[9] Numerous researchers have reported greater satisfaction rate of patients with the utilisation of tele-rehabilitation services, strengthening the assumption that provision of rehabilitation care from distance may be a feasible substitute to standard care.[9]

In spite of satisfactory acceptable results as well as recommendations from health plans for cost reduction by shortening the length of hospital stay, the technology of tele-rehabilitation is still not extensively available and utilised. The major explanation for this gap between current evidence and tele-rehabilitation services exists due to technical necessities needed for settling intervention surroundings in remote areas. Another reason is that a wide coverage of network is needed to reach distant locations. Till now, reviews are available on tele-rehabilitation targeting mostly neurological rehabilitation.[10]

Recently, Shukla et al. published their first review with meta-analysis on the role of tele-rehabilitation with comparison to face-to-face rehabilitation in patients post-total knee replacement (TKA). They concluded that tele-rehabilitation proved to be a practical substitute to traditional rehabilitation in individuals who had undergone knee arthroplasty.[11] It does not seem easy to argue over the effectiveness of tele-rehabilitation utilised in a remote setting compared to the standard face-to-face rehabilitation services delivered in person.

THR is considered to be a high-volume surgical procedure with good prognosis, and physical rehabilitation plays an important role in the recovery process of these patients. The current systematic review was planned to evaluate the effectiveness of tele-rehabilitation as a practical alternative to traditional face-to-face rehabilitation in THR patients.

Methods

The systematic review comprised search of Cochrane, Medline, Embase and PEDro databases from 2000 to date for English-language, human studies dealing with postoperative rehabilitation of THR patients. Approved for the systematic review was obtained from the institutional review board of the University of Lahore, Lahore, Pakistan. A thorough search was performed to retrieve articles missed through databases as well as unpublished grey literature from trial registers, clinical study reports, dissertations and theses, conference abstracts and proceedings. A conference paper was found on pre- and post-surgical tele-rehabilitation post arthroplasty which was presented in an e-conference.[12] The digital library of the Higher Education Commission (HEC) was also searched. Two major journals in telemedicine were hand-searched for additional relevant references; namely the Journal of Telemedicine and Telecare, and the Telemedicine Journal and e-Health. Searches through related articles from Pubmed, contacting local and international experts in the field and contacting authors for opinions were done as part of the screening of relevant studies. The search strategy was designed by combining Boolean operators and key terms related to the review objectives. Hand-searching of the references provided in the included studies was done to locate any relevant clinical trial missed through database search. Direct contact was made with local experts in THA and tele-rehabilitation to recognise any trial not spotted during the search process. Two authors independently searched the databases and retrieved all relevant data using a standardised abstraction form. Full text articles were retrieved for eligibility, or in case of conflict between the two researchers. A formal discussion was planned in case of conflict between the authors. Study eligibility criteria were based on the population, intervention, control, and outcomes (PICOS) format.[13] Clinical trials (CTs) and randomised clinical trials (RCTs) were included in the review. Studies in any language other than English, having population other than hip replacement subjects, or those targeting preoperative rehabilitation were excluded. The methodological quality assessment of the included studies was performed using the Cochrane risk of bias tool.[14] It has been used for the determination of both randomised as well as non-randomized health trials. Bias is assessed as a judgment graded as high, low or unclear for individual elements from domains, such as selection, performance, attrition, reporting and others. The included studies were critically appraised using the 10-point PEDro scale.[15] A score of 7 or higher was considered high quality, whereas score of 5-6 was considered fair, and <4 was taken as poor. Key terms utilised for searching the Pubmed database were coined (Table 1).

Data was synthesised through vote-counting as the descriptive tool. Data was presented visually by tabulation. Characteristics of the included studies were reported and summary of outcomes of interest, such as physical activity and quality of life (QOL) were focussed upon.

Result

Of the 165 studies found, 150(90.9%) were through the various databases. After exclusion on various counts, 25(16.7%) studies were selected for full-text review. Of

them, 12(48%) were excluded after review (Table 2), while 2(8%) had to be excluded because full text was non-extractable, and 11(44%) were subjected to detailed review (Figure). Of these 11, 4(36.4%) were randomised trials, 3(27.3%) each were randomised controlled protocols and randomised pilot studies, while 1(9%) was a prospective cohort study. Each study was analysed on the basis of selection, performance and other biases (Table 3). Overall, 8(72.7%) studies were of 'high' quality and 3(27.3%) fell under the category of 'fair' (Table 4).

Table-1: Search strategy used in Pubmed.

Sr.No	Search Terms
1	Tele-rehabilitation
2	Telemedicine OR tele-rehabilitation OR Mobile Health OR Remote rehabilitation OR eHealth
3	#1 OR #2
4	'Arthroplasty, Replacement, Hip'
5	Hip replacement OR hip arthroplasty OR Joint replacement
6	#4 OR #5
7	#3 AND #6
8	#7 AND [humans]/lim AND [english]/lim [2000–2018]/py.

Table-2: Reasons for exclusion of studies following assessment of full text.

Study	Exclusion Reason
Adamse (2017)[10]	A systematic review on chronic pain
Hoffmann(2008)[35]	Pre operative rehabilitation
Mahomed(2008)[36]	TKR as study population
Visser (2011)[37]	Only physical function as outcome measure
Rodenas (2008)[38]	TKR as study population
Moffet (2015)[39]	Targeted only TKR population
Theodoros (2008)[8]	Tele-rehabilitation role as general, not condition specific
Ninnis (2018)[26]	Focussed on OT perspective
Pastora (2017)[28]	A systematic review following orthopedic surgery
Josephine (2017)[29]	Review and meta-analysis

TKR: Total knee replacement, OT: Operation theatre.

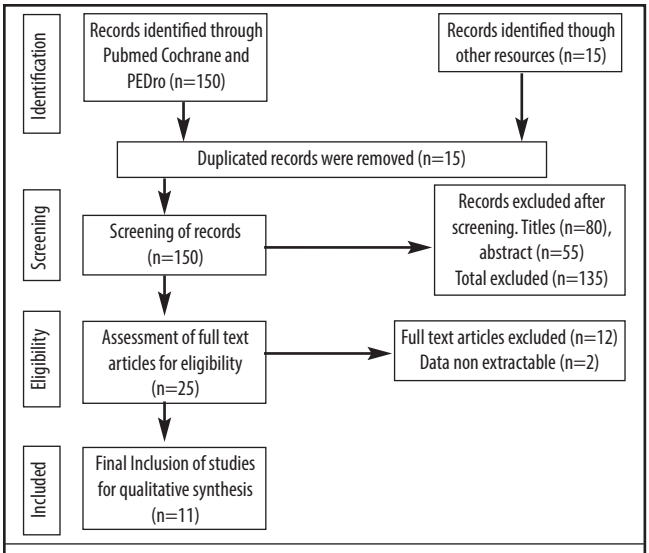

Figure: Preferred reporting items for systematic reviews and meta analysis (PRISM) flow-chart

Discussion

The current systematic review gives an outlook of the effects of electronic health (e-health) management through telecommunication means after THR. All the included studies concluded that tele-rehabilitation was a practical substitute to standard face-to-face treatment. Utilisation of tele-rehabilitation services suggests a probable solution to managing the ever-increasing demand of patient healthcare.[16]

The findings from the studies integrated in the systematic review also highlighted that tele-rehabilitation mode of exercise delivery was as effective as the traditional method of treatment in improving outcomes, like physical activity and QoL. These improvements might be accredited to the easiness of access for patients living in remote areas. Thus, they can continue their treatment at home more efficiently. This would consequently lead to greater number of therapy session in tele-rehabilitation compared to the standard method. The mission and aim of successful application and execution of different tele-rehabilitation plans, for example, home-based tele-health system, still remains an under-explored area.[17]

It is of ultimate significance that individualised patient experiences of different healthcare services must be taken into account while applying tele-health services, involving the most commonly used home-based tele-rehabilitation. Although the importance of patient's beliefs and attitudes has been identified, it still appeared to be a missing aspect from various studies.[18] Documentation of patient experiences about tele-health depends on the satisfaction rate. This concept is mainly presented by the usage of different questionnaires, tools and surveys, chiefly attending the technical characteristics of utilising the technology and the pattern of communication among patients.

One of the major benefits of tele-rehabilitation identified was the elimination of transportation time and hassle for patients as well as the therapists. A study evaluated the perception of patients and therapists in utilising tele-rehabilitation after hip replacement surgery. It highlighted that patients had positive experiences regarding tele-rehabilitation and they preferred it over the standard face-to-face treatment as PT sessions were individualised through the use of computers. Sufficient evidence of effectiveness of tele-rehabilitation was seen for outcome of physical activity and QoL (p<0.001) on pre- and post-intervention readings.[19] Significant effects were seen in the included studies for the Harris hip score when compared

Table-3: Characteristics of the included studies.

Study	Study Design	Population	Intervention	Outcomes
Anton (2015) [23]	Clinical trial	Primary THR average age 56 (range 33–67 years), 4 Males, 3 Women	I: Kinect Rehabilitation System C: None	Movement performance , movement execution
Correia (2019) [12]	Single centre pilot study	Post THA Total 66 (35 in digital group, 31 in conventional group) Mean age 62.4, 15 females in digital group and 16 females in conventional group	Both groups received 8 weeks program after 5 to 7 day post op. I: digital group received exercise independently through system C: conventional group received supervised home therapy	Mobility measured through timed up and go test Activities and quality of life (QoL) through HOOS.
Eichler (2017)[4]	Protocol for randomized controlled trial	After hip or knee replacement	I: 3 months tele-rehabilitation using MyRehab system C: voluntary usual care	IPAQ, SF 36, WOMAC, Timed up and Go test, Gait analysis, Postural control, stair ascend test
Eisermann (2004)[30]	Randomized Controlled trial	First total hip or knee replacement 189 women, 85 men. Mean age 69 yrs (38 to 86 yrs)	I: Computer aided training C: Conventional training	Harris hip score, FIM, hospital for special surgery score Hanover Functional Ability Questionnaire
Hoogland (2019)[31]	Prospective cohort study	30 THA patients, mean age 64 years; 9 male, 21 females	I: 12-week, home exercise programme following THA, with video instructions on a tablet PC	Physical activity through necklace motion sensor , user evaluation questionnaire, adherence rate
Hordam (2010)[32]	Randomized clinical trial	Total 180 patients, 68 in intervention group(21 male,47 female, mean age 75) 93 in Control group(35 male,58 female, mean age 74.8)	Both group received standard intervention I: received tele phone support and counselling	Health status measured by the SF-36
Lan-Li (2014)[33]	Randomized clinical trial	249 post THR patients divided into control and intervention group	I: Intervention through telephone C: routine health education and follow up	Harris hip score
Nelson (2017)[1]	Randomized controlled trial protocol	70 patients post THR	I: technology based THR program via iPad C: In person care	QoL subscale of the hip disability and osteoarthritis outcome score
Saunders (2018)[21]	Randomized controlled trial protocol	100 patients after primary elective THR. 50 on intervention group, 50 in control group	I: same as standard care and e health programme. C: one hour education session through education booklet	Euro QoL Hip dysfunction and Osteoarthritis outcome score
Saunders (2018)[22]	Prospective study	4 community dwelling elderly patients discharged from acute hospital settings post THA	I: tele-rehabilitation services with trained individual at home C: face to face session	Berg balance, 30 sec chair stand test, timed up and go , satisfaction with use of technology
Kalron (2018)[34]	Pilot randomized controlled trial	40 participants after hip surgery 22 male and 18 female mean age 67.5	I: Tele-rehabilitation group received video clips of common rehabilitation exercises targeting the lower extremities. C: received an exercise booklet	Timed Up and Go (TUG) test, 2-min walk test, 10-m walk test, sit to stand test, walking speed, mean step length

THR: Total hip replacement, THA: Total hip arthroplasty, IPAQ: International physical activity questionnaire, SF-36: Short Form 36 health survey questionnaire, WOMAC: Western Ontario and McMaster Universities osteoarthritis index, HOOS: Hip disability osteoarthritis outcome score, FIM: Functional independence measure.

between tele-rehabilitation and control group.

In the current situation, tele-rehabilitation method of treatment delivery at home has been designed to encourage practitioners monitoring and managing rehabilitation sessions from distant locations. These new modes of treatment have established a potential to decrease health costs linked with supervision, facility administration and transport issues of patients, while providing equal, but not better, clinical outcomes as the traditional face-to-face therapy for hip replacement.[20]

Previous studies have provided beneficial effects of tele-rehabilitation in numerous post-surgical orthopaedic conditions. A large amount of research in this particular area has mostly targeted population with total knee arthroplasty (TKA). Several randomised trials compared the efficacy of tele-rehabilitation technology to the traditional face-to-face rehabilitation in knee replacement patients.[21] Tousignant et al. concluded that tele-rehabilitation not only provided comparable outcomes for TKA patients, but also resulted in increased level of satisfaction.[22]

Table-4: Summary of PEDro scores of the included studies.

Study	2	3	4	5	6	7	8	9	10	11	Total Score	Quality
Anton (2015)	Y	N	Y	N	N	Y	Y	Y	Y	Y	7	High
Correia (2019)	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8	High
Eichler (2017)	Y	Y	Y	N	N	Y	Y	Y	N	N	6	Fair
Eisermann (2004)	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8	High
Hoogland (2019)	N	N	Y	N	Y	Y	Y	Y	Y	Y	7	High
Hordam (2010)	Y	Y	N	N	Y	Y	Y	Y	Y	Y	8	High
Lan-Li (2014)	Y	Y	N	N	Y	Y	Y	Y	N	Y	7	High
Nelson (2017)	Y	Y	N	N	Y	Y	Y	Y	N	N	6	Fair
Saunders (2018)	Y	Y	N	N	Y	Y	Y	N	Y	N	6	Fair
Tousignant (2006)	Y	Y	N	N	Y	Y	Y	Y	Y	Y	8	High
Kalron (2018)	Y	Y	N	N	Y	Y	Y	Y	Y	Y	8	High

Y: Criteria satisfied; N: Criteria not satisfied

A substitute medium for delivering education to the patient is via e-health. The World Health Organisation (WHO) describes e-health as "utilisation of technology for the purpose of health". The key concept of e-health is to provide support to the patient at stages prior, during and after the operation. This has the strength to enhance patient commitment, personalised care and clinical outcomes during the whole surgical journey. The application of e-health programmes allows a particular source of valid information which could be updated on a regular bases with new information.[23]

With extensive range of therapeutic technologies currently present in the health system, the mode of delivery should be tailored according to the patient's experiences and preferences. Attitudes of participants must not impact the capacity to apply tele-rehabilitation sessions. However, guidance should be provided to the provider of healthcare services in tailoring the exercise sessions according to patients' preferences and expectations. As identified in literature, majority of patients prefer telephone calls and video clips, but the physical therapist must take into account the need for feedback and visual participation when utilising tele-rehabilitation services.[24]

Despite documented benefits of easy access, cost-effectiveness and higher adherence rates, limited studies are present which provide data on outcomes of tele-rehabilitation for patients following THR. Randomised clinical protocols are registered, but results have to be uploaded. Numerous pilot studies have reported promising results in terms of cost-effectiveness and mobility outcomes.[25] However, studies included in the current systematic review have shown that rehabilitation through telecommunication method is a practical substitute to outpatient or home-based supervised therapy.

The current review revealed that although heterogeneity exists among the included studies in aspects of study designs, locations, outcome measures, mode of delivery, etc., there is a constant pattern in the studies encouraging the use of tele-rehabilitation and promoting its effectiveness. Numerous good-quality studies with comparison group reported equal or better clinical outcomes compared to the standard mode of treatment. A few studies highlighted the positive trends towards adherence rate and compliance.[26]

This innovative technology mode of delivery of rehabilitation services provides a paradigm shift in the domain of rehabilitation.[27] A key point of the current systematic review is that evidence has been summarised regarding the utilisation of tele-rehabilitation for improving physical activity and enhancing long-term goal of QoL among THR patients. The current review opens a window of opportunity for practicing physical therapists in Pakistan to manage access and cost issues by adopting tele-rehabilitation as a practical alternative to the standard face-to-face rehabilitation. One of the important limitations of the current review is the level of quality of the included studies. Different designs of study and the inclusion of only English-language studies have limited the comparison element across the studies. Besides, assessment of only two outcomes was considered. Future research is needed to evaluate the utilisation of tele-rehabilitation in real-life circumstances, using high-quality research methodologies. Comparative long-term effects of tele-rehabilitation and traditional rehabilitation should be evaluated.

Conclusion

Tele-rehabilitation group depicted similar improvement in terms of physical activity and QoL as did those having had traditional rehabilitation. Home-based tele-rehabilitation mode of healthcare services delivery is an acceptable practical alternative among THA patients. Tele-rehabilitation seems to be a substitute option for standard face-to-face rehabilitation.

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