International Journal of Multidisciplinary Research and Development
www.allsubjectjournal.com
ISSN Online: 2349-4182 ISSN Print: 2349-5979
Received: 24-10-2025, Accepted: 23-11-2025, Published: 08-12-2025
Volume 12, Issue 12, 2025, Page No. 70-74

Smartphone as an assistive interface for telerehabilitation: A Follow-Up Study for Nonspecific Neck Pain

Aakanksha Yadav[2], Kirti Panwar[2], Arushi Preeti Tirkey[2], Mayank Shukla[1]
[1] Professor, Department of Physiotherapy, Sharda School of Allied Health Sciences, Sharda University, Greater Noida, Uttar Pradesh, India
[2] Department of Physiotherapy, Sharda School of Allied Health Sciences, Sharda University, Greater Noida, Uttar Pradesh, India

Abstract
Background: Non-specific neck pain (NSNP) is a common musculoskeletal condition in young adults, frequently associated with poor posture, psychosocial stress, and sedentary behaviour, and continuous screen time on smartphones. Successful rehabilitation methods, particularly telerehabilitation follow-up, have gained prominence due to their accessibility and flexibility. Objective: To compare the efficacy of telerehabilitation follow-up using smartphones vs. no follow-up intervention in young adults recovering from NSNP after initial treatment, with the Neck Disability Index (NDI) as the main outcome measure.
Methods: 20 young adults with NSNP were randomly assigned to two equal groups (Group A and Group B; n=10 each). All subjects filled out the NDI questionnaire at three points 1. Pre-treatment (baseline) 2. Post initial (surgical/clinical) treatment 3. Follow-up post –up post- one week of telerehabilitation. Group A had a one-week telerehabilitation follow-up program consisting of supervised neck exercises, posture correction, and ergonomic counselling through video call on smartphones. Group B received no additional intervention following their first treatment. NDI scores were compared to identify functional changes and symptom decrease between and within groups.
Results: Both groups improved following initial treatment. Group A, however, had a significantly higher decrease in NDI scores following the telerehabilitation phase ($p < 0.05$) than Group B. Group A participants reported improved neck function, decreased pain, and enhanced performance of daily activities. These findings are in line with current literature attesting to the advantages of organized, home-based physiotherapy interventions.
Conclusion: Telerehabilitation follow-up using video call on smartphones considerably improves functional recovery and decreases neck disability in young adults with non-specific neck pain. Adding telerehabilitation physiotherapy to routine post-treatment practices can enhance outcomes and accessibility, particularly for technology-friendly and time-conscious youth populations.

Keywords: Tele physiotherapy, neck pain, young adults, technology

Introduction

Non-specific neck pain (NSNP) is one of the common musculoskeletal disorders and is also recognized as the fourth leading cause of physical disability worldwide (Jahre *et al*., 2021) [7]. NSNP is the condition with a substantial impact on individuals, particularly among young adults, leading to excess healthcare spending and reduced quality of life (McLean *et al*., 2010) [10]. NSNP is characterized by pain in the posterior and lateral regions of the neck, between the superior nuchal line and the first thoracic spinous process, with no recognizable structural anomaly or neurological deficit. NSNP is prevalent, particularly in young adults, attributed to prolonged use of the screen, poor postures, and lack of physical activity (Maayah, *et al*., 2018). The prevalence has been found to affect women more than men, with reported rates of 25.68% and 12.54%, respectively (Jahre *et al*., 2021) [7]. Smartphone use has been associated with neck pain (Ayhualem *et al*., 2021) [1]. Clinical findings comprise persistant pain, stiffness, limited range of motion, and related conditions like episodic headaches and tenderness of the muscles (Irgens *et al*., 2022) [6]. These manifestations result in functional impairment, affecting the performance of daily activities and work. NSNP is primarily diagnosed through clinical evaluation, including patient history and physical examination, with serious pathologies being ruled out (Binder, 2008) [2]. Diagnostic imaging methods such as X-rays, MRI, and electromyography (EMG) are used in cases where neurological symptoms are present. Management strategies prioritize conservative treatments, including manual therapy, therapeutic exercises, electrotherapy, and patient education (Bernal-Utrera *et al*., 2020) [3]. Research supports multimodal approaches that combine manual therapy with structured exercise regimens to reduce pain, improve function, and decrease disability. Tele-rehabilitation is a revolutionary method that uses digital technology to offer remote physiotherapy services (Jeong, and Lee., 2024) [8]. It provides a host of advantages, including enhanced accessibility, cost-effectiveness, and increased patient participation. AI-powered telerehabilitation enhances traditional rehabilitation by providing customized treatment plans, instant feedback, and compliance tracking Valenza-Pena, *et al*., 2024 [9, 12]. This method is especially useful for young adults, who need flexible and interactive rehabilitation options adaptable to their dynamic lifestyles (Jeong, and Lee., 2024) [8].

Methodology

Inclusion and exclusion criteria Inclusion: - 1. People with age ranging from 19 to 28 years old. 2. Experience of neck

pain without any condition. Exclusion: - 1. people having neck pain due to any kind of trauma, malignancy, cervicogenic headache, cervical radiculopathy and any other pathology were all excluded.

Study Design This is a prospective study with a repeated-measure design to evaluate the effectiveness of telerehabilitation on young adults with non-specific neck pain. This study was conducted as a cross-sectional survey to assess the prevalence, impact and treatment outcomes of neck pain.

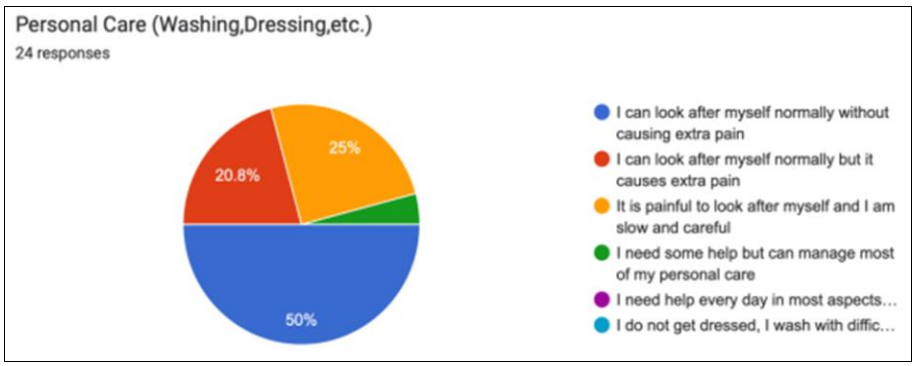
Ethical Approval: informed consent was taken from all participants and the review was done during the RBL 2025-26, review meeting of the department of physiotherapy SAHS.

Study Content The study includes measuring pain and functional disability of patients with non-specific neck pain with the aid of the Neck Disability Index (NDI) questionnaire. The measurement was carried out in three phases: 1. Pre-treatment baseline 2. Post initial (surgical or clinical) treatment 3. Post one week of telerehabilitation follow-up Sample Size There were total of 20 participants aged between 19 to 28 years both male and female were recruited for the study through inclusion and exclusion criteria. Study Setting The telerehabilitation and follow up was carried out through an online platform (telecommunication through video calls and messaging apps). Initial treatment data were gathered from an online survey. Instrumentation Neck Disability Index (NDI) Questionnaire – subjective measure of neck pain. Telecommunication Tools – Google Meet/Zoom for telerehabilitation sessions via smartphones. Microsoft Excel/Google Sheets – data entry and analysis. Variables Independent Variable: Telerehabilitation program (post-intervention). Dependent Variable: NDI score (pain and functional disability level). Control Variable: Time interval (baseline, post-treatment, and post-telerehabilitation). Outcome Measure Primary Outcome: Change in NDI scores over the three phases. Decrease in NDI score reflects improvement in neck function and decrease in pain/disability.

Procedure and Protocol

1. Recruitment and Consent: 20 young adults with non-specific neck pain were recruited. Consent was taken for participation and use of data.
2. Initial Assessment: Participants completed the NDI questionnaire prior to any treatment, which was taken as the baseline score.
3. Post-Treatment Assessment: After their first clinical intervention which was some basic stretching of neck and shoulder muscle, isometric exercises of neck, MFR on neck, strengthening exercises and postural correction exercises. participants were reassessed using the NDI. And then all the participants were divided into two equal groups [group A and group B]. Then we gave telerehabilitation to group A and didn't give any telerehabilitation to group B.
4. Telerehabilitation intervention Participants underwent one week of telerehabilitation comprising supervised neck exercises which included self-stretching, isometrics, hot and cold therapy and ergonomics guidance with postural correction exercises provided through video call.
5. Final asssessment NDI form was filled again after one week of telerehabilitation.
6. Data analysis All NDI scores were compared at three time points to evaluate changes in pain and functions.

Results: This study assessed the prevalence, impact, and treatment outcomes of non-specific chronic neck pain (NSNP) in young adults, using the Neck Disability Index (NDI) scale. The sample included 20 participants, aged 19-28 years, both male and female, who reported neck pain without any underlying pathology. The results revealed that pain intensity was a significant issue for most participants, with varying levels of severity impacting their daily activities as seen in figure 1 for the pre, post and followup data. Many participants experienced difficulties with personal care, lifting, and reading, while a notable percentage reported secondary symptoms like headaches, impaired concentration, and sleep disturbances. Work, driving, and recreational activities were also affected, indicating the broad functional limitations caused by NSNP. Tele-rehabilitation, involving virtual follow-ups and prescribed exercises (neck isometrics, muscle stretching, and posture correction), was implemented to manage these symptoms as seen in the figure-2. The results suggested that participants who engaged in the prescribed exercises via smartphone meetings experienced reductions in pain intensity, improved functionality in personal and work-related tasks, and better sleep quality and improvement in recreational activities as well as seen in figure-3. The findings underline the substantial impact of NSNP on quality of life and highlight the effectiveness of tele-rehabilitation via smartphone in improving outcomes, offering a flexible and accessible approach to managing this common musculoskeletal condition.



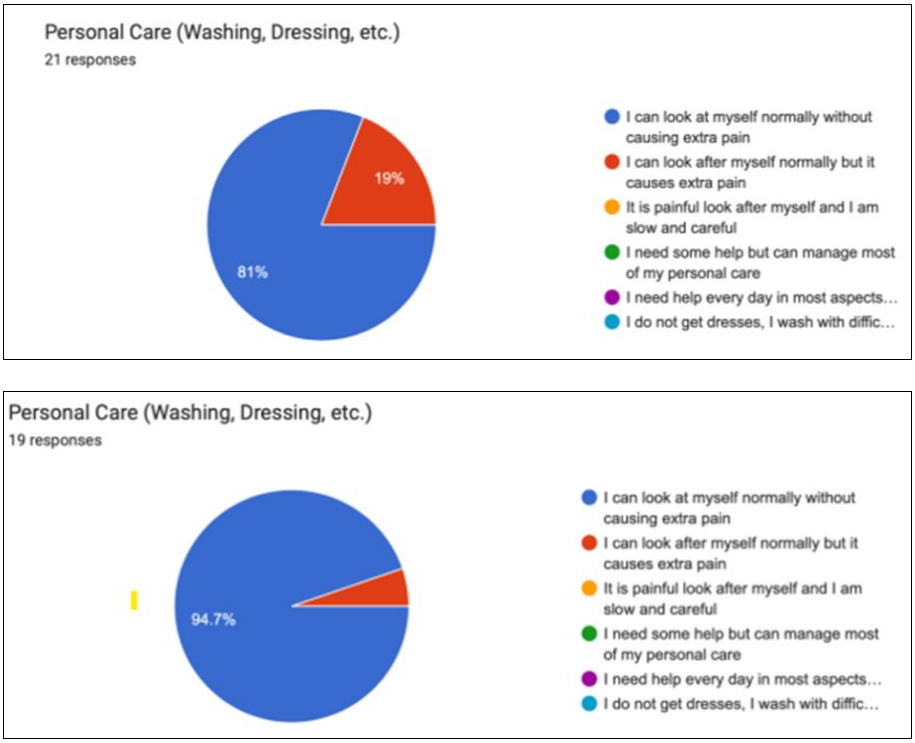


Fig 1: Personal career-related responses pre, post & follow up–telerehabilitation of the participants n=24.

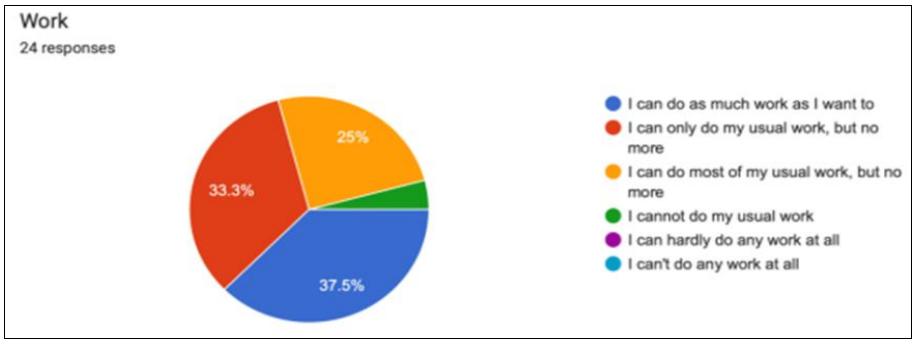
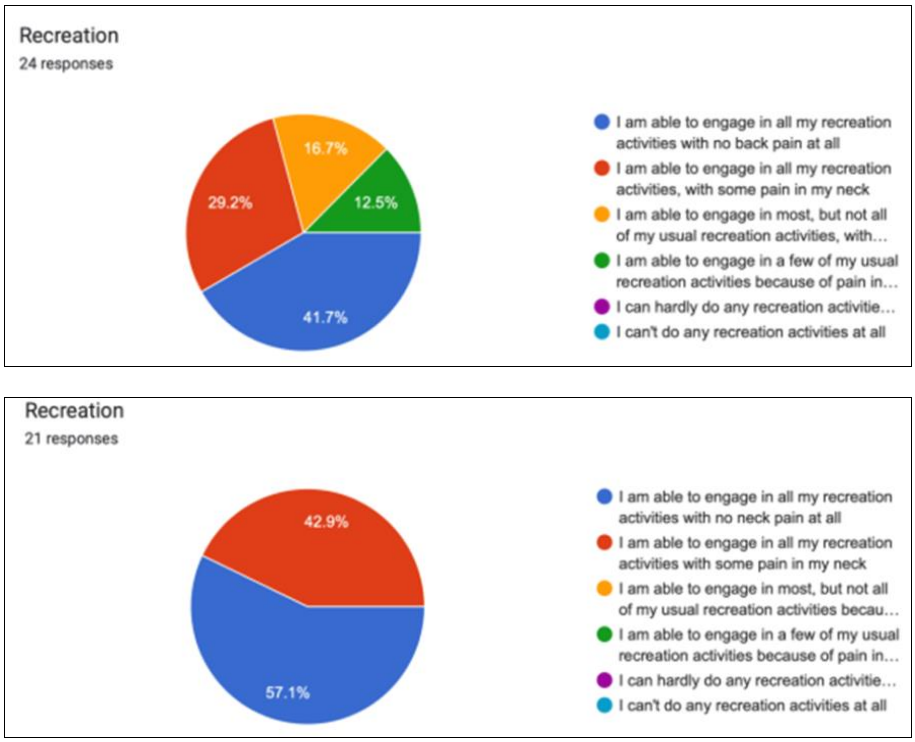


Fig 2: Work-related responses pre, post & follow-up–telerehabilitation of the participants n=24.



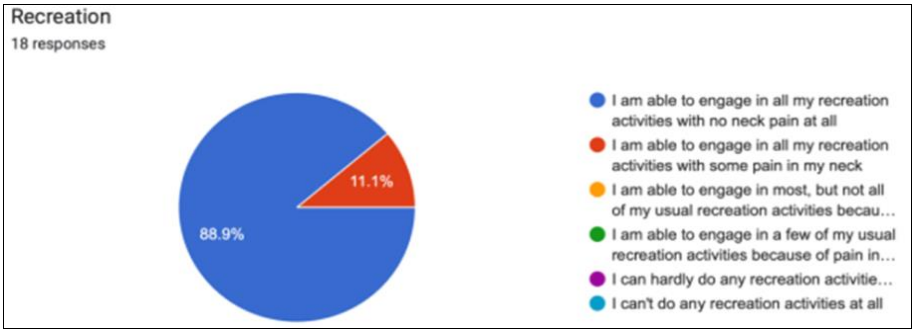


Fig 3: Recreational responses pre, post & follow up–telerehabilitation of the participants n=24.

This study assessed the prevalence, impact, and treatment outcomes of non-specific chronic neck pain (NSNP) in young adults, using the Neck Disability Index (NDI) scale. The sample included 20 participants, aged 19-28 years, both male and female, who reported neck pain without any underlying pathology. The results revealed that pain intensity was a significant issue for most participants, with varying levels of severity impacting their daily activities. Many participants experienced difficulties with personal care, lifting, and reading, while a notable percentage reported secondary symptoms like headaches, impaired concentration, and sleep disturbances. Work, driving, and recreational activities were also affected, indicating the broad functional limitations caused by NSNP. Tele-rehabilitation, involving virtual follow-ups and prescribed exercises (neck isometrics, muscle stretching, and posture correction), was implemented to manage these symptoms. The results suggested that participants who engaged in the prescribed exercises experienced reductions in pain intensity, improved functionality in personal and work-related tasks, and better sleep quality. The findings underline the substantial impact of NSNP on quality of life and highlight the effectiveness of tele-rehabilitation in improving outcomes, offering a flexible and accessible approach to managing this common musculoskeletal condition.

Discussion The present comparative study explored the efficacy of telerehabilitation follow-up in young adults with non-specific neck pain (NSNP) via smartphones after initial treatment, there are similar studies by Valenza-Pena *et al*., (2024) [8, 12] but in a Cochrane reviewby Fadim *et al*., 2025 the evidence is inconclusive. In our study, application of a standardized follow-up program through telecommunication revealed positive outcomes in enhancing functional status and diminishing disability, as indicated by the Neck Disability Index (NDI) similar to the study of Valenza-Pena., *et al*, (2024) [8, 12]. Interpretation of Findings Both groups (A and B) had improvement in NDI scores following initial treatment, reflecting that the clinical interventions were successful in treating the acute symptoms of NSNP. Group A, receiving a one-week telerehabilitation follow-up, however, had a statistically significantly higher reduction of NDI scores than Group B. This indicates that ongoing rehabilitation through distant support is crucial in maintaining and augmenting functional recovery. Young adults are especially susceptible to NSNP because Physiological and psychosocial relevance of lifestyle aspects such as excessive Tele-Vision watching, sitting for prolonged periods of time, and improper ergonomic practices are the risk factors as explained by Jahre *et al*., (2021) [1, 7]. Psychological stress, social isolation, and low physical activity have also been demonstrated to initiate and maintain the condition of neck pain Igwesi-Chidobe and Nkhata, 2025 [5, 11]. Telerehabilitation targets these elements not only through physical therapy exercises, but also by maintaining patients motivated, under surveillance, and psychologically supported throughout their recovery process Jeong and Lee, 2024 [7, 8]. In addition, the findings prove that remote interventions are not only possible but also successful at enhancing outcomes, particularly for young age groups that are technologically savvy and prefer flexible home-based models of therapy Valenza-Pena *et al*.,2024 [8, 12], they are reported to improve kinesiophobia as well Ozden *et al*., 2023 [12]. Clinical Implications The findings underscore the importance of incorporating telerehabilitation into post-treatment schedules of NSNP. It offers a cost-efficient, convenient, and expandable alternative to face- to-face therapy particularly beneficial for those with busy schedule or time constraints. Physiotherapists and clinicians must explore hybrid models of care where treatment is initiated and then followed up in a structured manner remotely.

Limitations Despite encouraging findings, the study was subject to various limitations: 1. Small Sample Size: The research covered only 20 participants, so it might not reflect the bigger population of young adults who have neck pain. 2. Brief Follow-Up Period: The duration of the telerehabilitation program was only one week, which may not be indicative of outcomes over the long term. 3. Self-Reported Outcome Measure: The use of NDI as a subjective tool might introduce bias due to individual perception and reporting variability. 4. Homogeneity of Sample: Only young adults were included, which limits generalizability to other age groups.

Future Recommendations 1. Larger, Randomized Controlled Trials: Future studies should involve a larger and more diverse sample size with random allocation to intervention and control groups. 2. Long-Term Follow-Up: Adding follow-ups at 1 month, 3 months, and 6 months after the intervention would give a better picture of telerehabilitation's long-term effectiveness.

Conclusion The present research illustrates that telerehabilitation via smartphone has the potential to be an efficient follow-up strategy for young adults with non-specific neck pain following initial treatment it significantly enhances recovery. The improvement in Neck Disability Index (NDI) scores during the three phases of assessment reveals that when guided and structured properly greatly improves functional outcome. Because smartphoines are

found universally with all telerehabilitation via smartphone may become the new techno trend for health.

Refrences

1. Ayhualem S, Alamer A, Dabi SD, Bogale KG, Abebe AB, Chala MB, *et al*. Burden of neck pain and associated factors among smart phone user students in University of Gondar, Ethiopia. PloS one,2021:16(9):0256794. https://doi.org/10.1371/journal.pone.0256794
2. Binder AI. Neck pain. BMJ clinical evidence, 2008, 1103.
3. Bernal-Utrera C, Gonzalez-Gerez JJ, Anarte-Lazo E, Rodriguez-Blanco C. Manual therapy versus therapeutic exercise in non-specific chronic neck pain: a randomized controlled trial. Trials,2020:21(1):682. https://doi.org/10.1186/s13063-020-04610-w
4. Fandim JV, Almeida de Oliveira L, Yamato TP, Kamper SJ, Costa LO, Maher CG, Saragiotto BT, *et al*. Telerehabilitation for neck pain. The Cochrane database of systematic reviews,2025:8(8):CD014428. https://doi.org/10.1002/14651858.CD014428.pub2
5. Igwesi-Chidobe CN, Nkhata LA. Editorial: Adaptive coping strategies for rehabilitation of people with non-specific chronic lower back pain or non-specific chronic neck pain. Frontiers in rehabilitation sciences,2025:6:1551777. https://doi.org/10.3389/fresc.2025.1551777
6. Irgens P, Myhrvold BL, Kongsted A, Waagan K, Engebretsen KB, Vøllestad NK, *et al*. The clinical course of neck pain: Are trajectory patterns stable over a 1-year period? European journal of pain (London, England),2022:26(2):531–542. https://doi.org/10.1002/ejp.1879
7. Jahre H, Grotle M, Småstuen M, Guddal MH, Smedbråten K, Richardsen KR, *et al*. Risk factors and risk profiles for neck pain in young adults: Prospective analyses from adolescence to young adulthood—The North-Trøndelag Health Study. PLOS ONE,2021:16(8):0256006.
8. Jeong GH, Lee BH. Effects of Telerehabilitation Combining Diaphragmatic Breathing Re-Education and Shoulder Stabilization Exercises on Neck Pain, Posture, and Function in Young Adult Men with Upper Crossed Syndrome: A Randomized Controlled Trial. Journal of clinical medicine,2024:13(6):1612. https://doi.org/10.3390/jcm13061612
9. Maayah MF, Nawasreh ZH, Gaowgzeh RAM, Neamatallah Z, Alfawaz SS, Alabasi UM, *et al*. Neck pain associated with smartphone usage among university students. PloS one,2023:18(6):0285451.
10. McLean SM, May S, Klaber-Moffett J, Sharp DM, Gardiner E. Risk factors for the onset of non-specific neck pain: a systematic review. Journal of epidemiology and community health,2010:64(7):565–572. https://doi.org/10.1136/jech.2009.090720
11. Özden F, Özkeskin M, Tümtürk İ, Yalın Kılınç C. The effect of exercise and education combination via telerehabilitation in patients with chronic neck pain: A randomized controlled trial. International journal of medical informatics,2023:180:105281. https://doi.org/10.1016/j.ijmedinf.2023.105281
12. Valenza-Peña G, Calvache-Mateo A, Valenza MC, Granados-Santiago M, Raya-Benítez J, Cabrera-Martos I, *et al*. Effects of Telerehabilitation on Pain and Disability in Patients with Chronic Neck Pain: A Systematic Review and Meta-Analysis. Healthcare (Basel, Switzerland),2024:12(7):796. https://doi.org/10.3390/healthcare12070796