PROTOCOL

The Effect of Text Message-based Support Program (TextRehab) on Treatment Outcomes of Patients with Hand Flexor Tendon Injuries after Repair: A Randomized Controlled Trial Study Protocol

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Abstract

Background: Post-operative rehabilitation for patients with flexor tendon injuries is necessary for a full recovery. This randomized controlled trial study investigates the effectiveness of a text message-based rehabilitation program (i.e., TextRehab) on the improvement rate of hand rehabilitation in patients with flexor tendon injuries after repair.

Methods: This study is designed as a randomized, three-month, single-center, two-arm, parallel controlled trial. A total of 40 patients will be randomly classified as either the control or intervention group. Both groups receive usual care; however, the intervention group is also asked to perform the designed rehabilitation activities through the TextRehab program. The activity instructions are sent to patients step by step at least once a day. Self-reported outcomes will be assessed at 6 and 12 weeks after discharge and include self-reported Patient Rated Wrist Evaluation, self-reported Quick-Disability of Arm, Shoulder, and Hand, and Visual Analogue Scale. Moreover, the reports of the physician regarding the grip strength and Total Active Motion will be assessed at week 12.

Results: The development of the message scheduling system and its contents is completed. This trial has the code of ethics in research (IR.MUMS.fm.REC.1396.247). Study results are expected to be available in mid-2021.

Conclusion: The TextRehab program is developed to provide advice, motivation, information, and care for patients with hand flexor tendon injuries after repair. This trial provides evidence of the effectiveness of sending text messages on persuading patients to perform home-based rehabilitation activities.

Level of evidence: Not applicable

Keywords: Flexor tendon injury, Home-based rehabilitation orthopedic, mHealth, Text message

Introduction

Most patients with flexor tendon injuries suffer from a limited range of motion, formation of adhesions, insufficient strengthening of muscles, and loss of functionality in their hands or fingers (1). Early mobility after surgery has been shown to improve hand functionality and prevent adhesion formation, stiffness, and deformity (2). The results of studies have also shown that post-operative rehabilitation programs improve the outcomes of hand functionality in patients with flexor tendon injuries (2-4). Adherence to physiotherapy

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programs, especially home exercise programs, can be low among patients due to either forgetting their exercise schedule or being exposed to pain during exercise (5). On the other hand, self-managed exercise is an attractive solution for home-based rehabilitation, especially when it is not possible to continue with outpatient rehabilitation (6).

Mobile Health (mHealth) is the use of mobile communication technologies, including mobile/cell phones using cellular networks, to improve health outcomes, healthcare services, and health research (7). Cell phone interventions enable patients and physiotherapists to reduce or eliminate barriers to physical exercises, such as transportation, financial cost, inadequate time, and bad weather conditions; therefore, such interventions increase adherence to a health management program (8). Text messaging is more practical due to the wider accessibility of people to mobile phones with short message service (SMS) than smartphones (9). There is a growing body of research supporting the use of text message-based interventional systems and instructional videos for increasing physical activities and self-managed exercises (10-16).

This study introduces the TextRehab program, and details the research protocol of a trial to determine the effectiveness of instructional videos and text messages delivered via TextRehab on improving patients' adherence to physical therapy (home-based rehabilitation) along with their usual care. This study hypothesizes that patients whose flexor tendon injuries have been repaired will perform post-operative home-rehabilitation programs more easily by using mobile phone intervention as a tool to increase self-care adherence. To the best of our knowledge, up to now, there has been no published study on the effect of text message-based self-care (home-based rehabilitation) interventions on patients with flexor tendon injuries.

Materials and Methods

2.1. Study Design

This protocol describes a randomized, three-month, single-center, two-arm, parallel controlled trial to evaluate the effectiveness of a text message-based rehabilitation program (TextRehab) on primary and secondary outcomes, which will be assessed at 6 and 12 weeks from baseline. This protocol is conducted in accord with the Standard Protocol Items: Recommendations for Interventional Trials 2013 statement (17), and the intervention is described according to the Consolidated Standards of Reporting Trials of Electronic and Mobile EHealth Applications and onLine TeleHealth checklist (18, 19).

The duration of the study is expected to be 16 months, which includes needs assessment, content development, TextRehab web-based management system development, participant recruitment, randomization, intervention allocation, intervention delivery, follow-up, and data analysis. The trial will be run for 12 weeks for each patient.

2.2. Randomization and allocation concealment

This study is designed as a randomized controlled trial. After the confirmation of eligibility, 40 participants will be randomized in a 1:1 ratio to either the intervention group (usual care plus the 90-day text messaging program) or the control group (usual care), using an online random number generator (randomization.com). A member of the research team will conceal the assignment of subjects to each group in sequentially numbered opaque, sealed envelopes.

2.3. Blinding and consenting

Due to the nature of the intervention, patients cannot be blinded; however, participants will not be aware that there are two research groups. The intervention applicator must know about the assignment details, after they are revealed, to manage to send text messages to participants in the intervention group.

The study coordinator performing the recruitment will be blinded until the patient has consented to participate. Written informed consent will be obtained from each eligible patient before entering the trial. After obtaining consent, the study coordinator begins to distribute the envelopes that encode patients to either the intervention or control group, which is performed by giving each patient the top envelope from the prepared stack of sealed envelopes.

Physicians who visit patients and physiotherapists who provide rehabilitation to participants are blinded to the allocation. Professional academic biostatisticians blinded to study groups will conduct all analyses.

2.4. Ethics approval

This trial has the code of ethics in research (IR.MUMS.fm.REC.1396.247).

2.5. Baseline measurement

After obtaining informed consent, at the baseline, information such as age, gender, education, marital status, affected side, smoking status, comorbidities, and past medical history will be collected.

2.6. Participants and setting

Hand surgeons will screen the patients who have undergone hand flexor tendon repair surgery at a level three academic hospital for clinical eligibility. Those who meet the eligibility criteria will be screened for the considerations of inclusion criteria by the principal investigator. Subsequently, the final patients will be recruited for this study. Inclusion criteria are adult patients having a hand and finger flexor tendon injury and having undergone repair, being over 18 years old, possessing a cell phone, being fully willing to participate in the study, and being able and willing to give informed consent. On the other hand, patients will be excluded if they have neurological or psychiatric diseases that would result in an inability to interact with a cell phone, are medically unstable, are unable to participate in the exercise program, or have any previous hand deformity, injury, or dysfunction. Moreover, they will be excluded if they have a concomitant hand or finger fracture, extensor

tendon injury, or treatment interval of more than 2 weeks.

Information about the study will be provided to patients after the surgery and before discharge. A designated phone number will be given to patients that can be contacted if they need help. Patients will be assessed at weeks 6 and 12 after discharge, and the analysis outcomes will be compared. A flow diagram of the trial's progression (i.e., recruitment, randomization, intervention allocation, follow-up, and data analysis) is shown in Figure 1.

2.7. System development (TextRehab)

The following phases will be used to design and develop the TextRehab system:

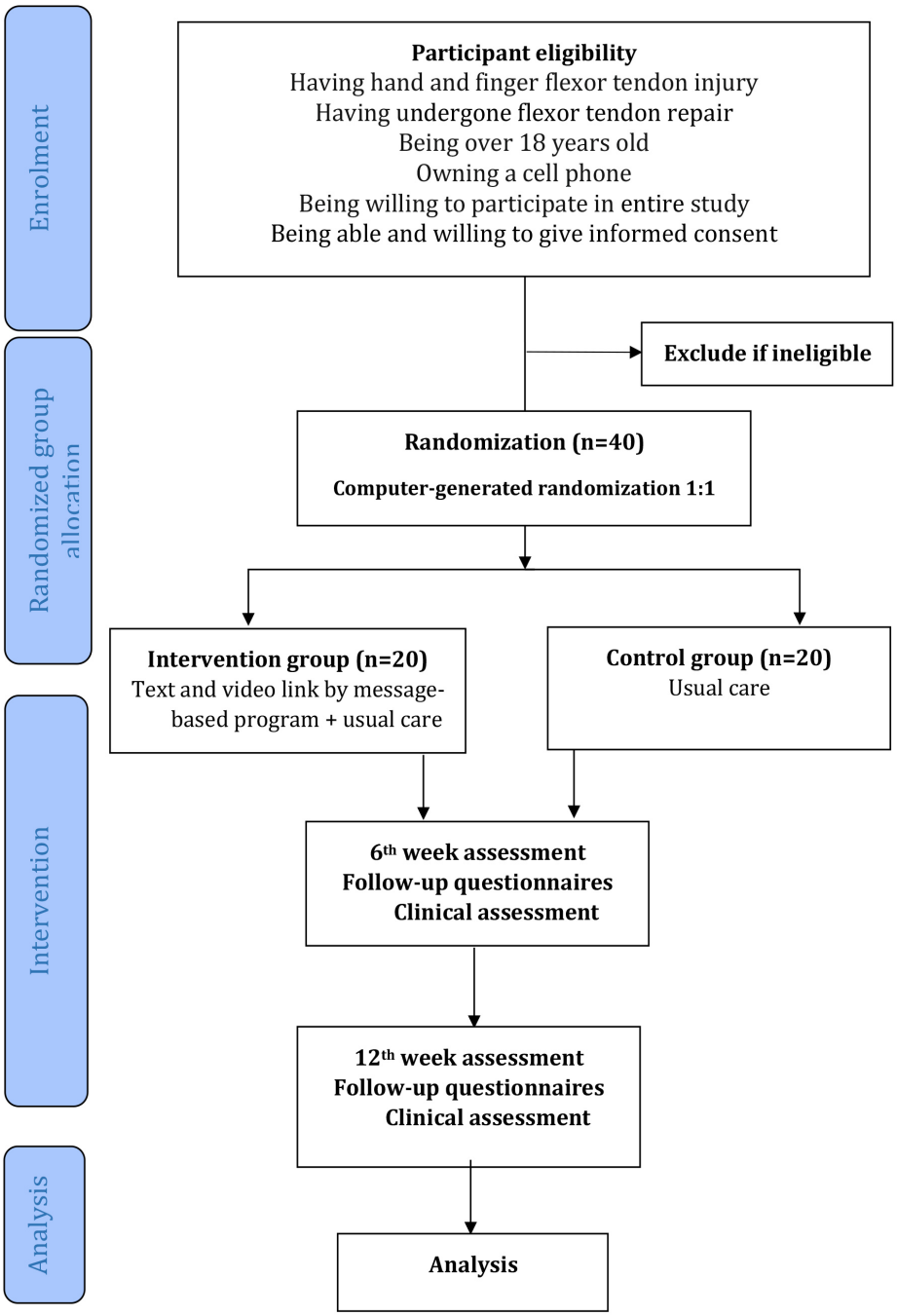

Figure 1. Flow diagram of the trial's progression.

2.7.1. Phase 1: Needs assessment

At first, a field survey will be conducted to obtain a general overview of patients' needs for information. For this purpose, one of the study researchers will take part in patients' visit sessions held by orthopedic specialists at a university orthopedic center for 1 month. Furthermore, by searching the scientific texts, articles, and rehabilitation protocols available in medical centers worldwide and consulting with two hand subspecialist surgeons, patients' needs were identified in terms of their health problems, activity constraints, criteria for preventing recurrence, financial resources, future referrals, pain and its management, activity onset, and recovery period for patients with flexor tendon injuries in each of the 5 flexor zones of the hand. Additionally, the follow-up process of patients with flexor tendon injuries was investigated after discharge.

2.7.2. Phase 2: content development

To prepare the rehabilitation instructional content, Duran therapeutic protocol suggested by specialists was used (20). This therapeutic protocol was specifically designed for patients suffering from hand flexor tendon injuries. Moreover, to be noted is that rehabilitation treatment is commonly recommended to patients at the center under study. Instructional content is then prepared in two formats, including text message and video, which are described in detail below.

- ***Text messages***

The purpose of text messages is to provide advice, motivation, information, and care. The messages are carefully designed in order to persuade patients to perform home-based rehabilitation exercises, using a specific therapeutic protocol for rehabilitation exercises of patients with hand tendon injuries. The content of messages was produced and edited, using a number of techniques recommended in behavioral change theories, which are known to be useful for persuading patients to perform specific behaviors.

A total of 104 text messages are developed based on a flexor tendon rehabilitation protocol (Duran), which is an early passive mobilization that can help yield excellent results.

Four groups of messages are developed, including:

- Dressing, wound care, duration of the splint wear, and bathing;
- Pain management;
- Follow-up appointments; and
- Rehabilitation exercise messages.

All messages are understandable for patients with any level of education and contain a link to the website.

After preparing the messages, the content is reviewed, edited, and approved by orthopedic super specialists and medical informatics specialists.

- ***Instructional videos based on corresponding text messages***

Instructional videos are prepared in accordance with each treatment stage and with regard to the text messages.

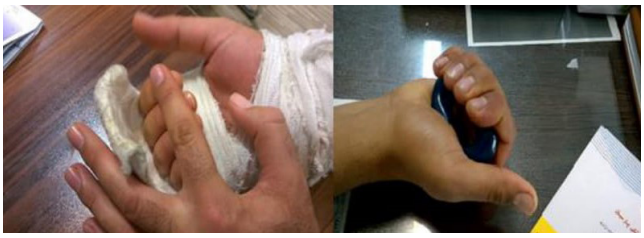

Figure 2. Screenshot of rehabilitation instructional videos.

Rehabilitation instructional videos are prepared with the help of hand surgeons for patients with flexor tendon injuries. An actual patient helps us with the recordings, and the videos are made according to treatment stages [Figure 2].

There is a link to the corresponding video at the end of all rehabilitation exercise text messages (URL links that direct patients to the website where rehabilitation videos are uploaded). Such multimodal content acts as a complementary resource for the better understanding of rehabilitation activities in addition to what can be provided in a text message.

2.7.3. Phase 3: Design and development of message scheduling system

The text message-based intervention will be delivered by our designed TextRehab web-based management system. This text message system delivers daily text messages. The information of participants randomized to the intervention group, including their characteristics, will be registered through our text messaging web-based management system. The program runs a series of background checks to ensure data accuracy. A log of all transactions with participants, including seen videos, time of sending messages, and delivery reports, is retained. After uploading the instructional videos on the website, it is possible for the research team to monitor the number of times the links are accessed.

To transfer and schedule the necessary recommendations from the physician to the patient in an effective way, various packages with different subjects can be defined on the website that can then be sent to patients at flexible times [Figure 3]. It should be mentioned though that the package sent to the study population will only be one specified package. Since the content of messages is already defined in each package, it is possible to deliver them in the form of SMS in a long interval of time which then allows for the completion of rehabilitation training.

The patients' follow-up system was designed and analyzed based on the patients' needs and with the help of a computer, medical informatics, and hand surgery specialists. This system was created with ASP.Net language using a visual studio as the web application. MySQL was also used to manage the databases.

2.8. Usual care

The control group will only receive appointment reminder text messages a day before their appointments.

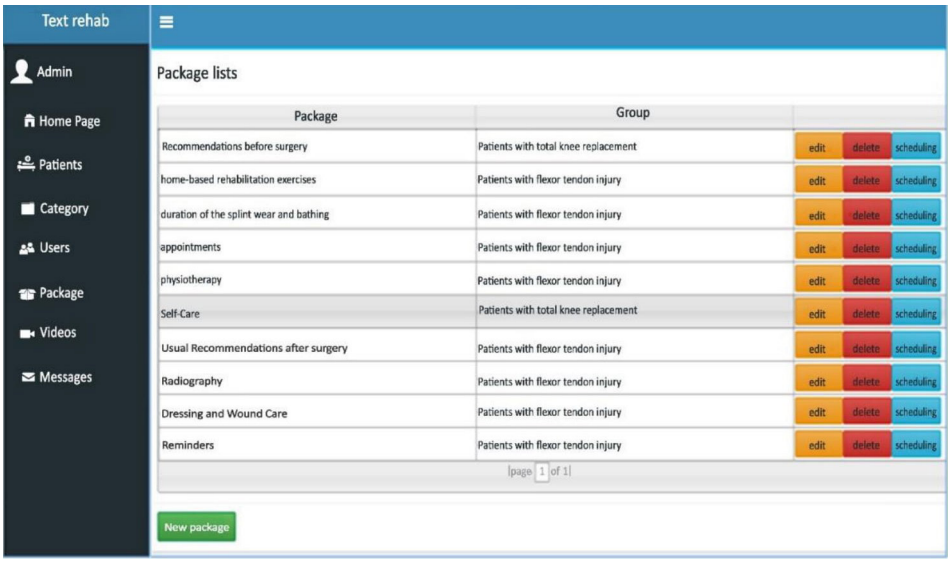

Figure 3. Screenshot of the package creation page.

Reminders contain the patient's name, location, clinic name, and date and time of the upcoming visit. The patients in this group will receive the usual care provided to all patients with flexor tendon injury after surgery, which might include rehabilitation as recommended by their hand surgeons if necessary.

2.9. Intervention

Participants in the intervention group will receive text messages about post-operative care for 12 weeks and appointment reminder text messages a day before their appointments at no cost. The text messaging program will begin the day after the participant's discharge from the hospital. The messaging intervention will be provided in addition to usual care provided to all patients with flexor tendon injury after surgery, which includes rehabilitation as recommended by their hand surgeons.

The content of the message will act as both a reminder and a cue to action. The content will change based on the Duran rehabilitation protocol throughout the study. At least one message will be sent per day, and the participants can choose when to receive messages throughout the day. Before the start of the intervention, a test message will be sent to each patient to confirm their phone numbers and check whether the system is working well. If patients do not receive messages, the intervention applicator will update the correct phone number. Participants are expected to use the messages for 12 weeks daily. Approximately 80% of messages contain links to the videos related to their content. A patient participating in the full 12-weeks intervention will receive a total of 104 messages. Participants are able to request to stop receiving the text messages by calling the intervention applicator.

2.10. Outcome measures

Self-reported outcome measures will be collected at two temporal points, namely 6 and 12 weeks post-operatively.

Primary outcome

The primary outcome measure is a 15-item self-reported questionnaire that will be used for rating wrist-related pain and disability in functional activities as measured by a translated version of the Patient Rated Wrist Evaluation (PRWE) (21). Each item is scored from 0 to 10. The score consists of two domains, including the pain domain (n=5 items) and the function domain (n=10 items). The total functionality score on the PRWE scale ranges from 0 (normal wrist) to 150 (complete disability) (22).

Secondary outcomes

Quick Disabilities of Arm, Shoulder, and Hand Score: A translated version of this questionnaire is used as a self-reported survey of function and symptoms in patients with upper extremity disorders (23). This 11-item tool assesses the ability to perform physical activities (n=8 items) and pain (n=2 items), and 1 item is related to sleep. Each item is scored on a 5-point Likert scale (from 1=least difficult or severe to 5=most difficult or severe), with a lower score indicating a better outcome (24).

Visual Analog Scale: Patients will be asked to fill out the 10-point Visual Analog Scale which questions the average pain level during the past 7 days. The total score of this tool ranges from 0 (no pain) to 10 (extreme pain) (25).

GRIP strength: The handgrip strength will be measured using a hydraulic hand dynamometer (SAEHAN Corporation, Masan-Korea) for both the injured and uninjured hands while the lower arm is resting on a flat surface and the elbow flexion is at a 90-degree angle. The total active motion (TAM) is calculated with the use of a goniometer at 12 weeks by the outcome assessor. A mean value from injured fingers is measured in patients with multiple finger injuries. The sum of flexion at the metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints in attempt fist position minus the sum of extension at these joints is used to compute TAM (26). Grip strength and TAM will be

evaluated 12 weeks after the discharge.

2.11. Sample size

Sample size calculations are based on the primary outcome of wrist function and wrist score (i.e. PRWE score). Moreover, an alpha error is assumed at 0.05, and the percentage of loss at follow-up is considered at 25%. Therefore, the final sample size is determined at 40 participants in order to provide 90% power to detect a difference of 10 points in the PRWE score, which is considered to be clinically relevant in this study.

2.12. Statistical analysis

All analyses will be performed based on an intention-to-treat method. Professional academic biostatisticians blinded to group allocation will analyze the data. The collected data will be analyzed in IBM SPSS Statistics 23.0. All analyses will be performed using two-sided *P-values* considered significant when below 0.05. The normality of the variables will be assessed using the Kolmogorov-Smirnov test. To demonstrate equivalency between groups, patient characteristics will be compared at the baseline using independent samples t-test for continuous variables (i.e., age and levels of education) and a Fisher's exact test or Chi-square test for categorical variables (i.e., smoking status, marital status, gender, affected side, level of injury [zone II to V]) as appropriate. Mann-Whitney U tests will be used where data are not normally distributed. Differences between primary and secondary outcomes in groups will be tested by independent samples t-test. Differences in the mean of primary outcome scores and secondary outcomes scores between 6 and 12 weeks will be assessed with the paired-samples t-tests. Where assumptions for parametric analysis have not been fulfilled, a non-parametric analysis will be replaced to make these comparisons.

Results

The study protocol has the code of ethics in research. The development of the message scheduling system is complete. Study results are expected to be available in mid-2021.

Discussion

This paper describes the protocol of a TextRehab trial designed to evaluate the effect of instructional text messages and videos as a home-based rehabilitation program compared to usual care. This type of intervention can provide self-care support within the intervals between the clinic visits for patients who are discharged from the hospital and live in areas far from the rehabilitation centers.

The findings of different studies have shown that after receiving textual messages, medication adherence has increased in patients with chronic diseases (27-29). Similarly, text messages have been able to effectively increase outpatients' attendance in healthcare centers (30). In addition, based on the results of studies, text messages have been able to improve physical activities in the elderly (10, 31, 32). This trial is also expected to help facilitate the process of communicating and reminding physicians' advice to patients within the intervals between the appointments. Moreover, early implementation and continuation of an uninterrupted care program will lead to full recovery and rehabilitation of patients, which in turn allows for a faster return to their normal routines.

The designed intervention of this study is prepared by a multidisciplinary team based on the rehabilitation protocols specific for patients with flexor tendon injuries. It is not possible to determine which component(s) of the TextRehab intervention are more effective for improving patients' hand functionality outcomes. However, if effective, this trial will be the first interventional study that demonstrates the effect of mHealth in the improvement of treatment outcomes in patients with flexor tendon injuries in a randomized controlled trial. The effectiveness of the TextRehab intervention, depending on patients' active participation, is potentially applicable to other populations. Another advantage of this study is related to the message delivering process that was designed as a one-way communication; therefore, the intervention is more practical and cost-effective for patients.

Finally, this trial may contribute to the literature regarding the use of mobile phone technology for improving health outcomes in all settings, especially low-resource ones.

Disclosure: The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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References

1. Skirven TM, Osterman AL, Fedorczyk J, Amadio PC. Rehabilitation of the hand and upper extremity, 2-volume set E-book: expert consult. Elsevier Health Sciences; 2011.
2. Saini N, Kundnani V, Patni P, Gupta S. Outcome of early active mobilization after flexor tendons repair in zones II-V in hand. Indian journal of orthopaedics. 2010;44:314-21.
3. Trumble TE, Vedder NB, Seiler III JG, Hanel DP, Diao E, Pettrone S. Zone-II flexor tendon repair: a randomized prospective trial of active place-and-hold therapy compared with passive motion therapy. JBJS. 2010;92(6):1381-9.
4. Bal S, Oz B, Gurgan A, Memis A, Demirdover C, Sahin B, et al. Anatomic and functional improvements achieved by rehabilitation in Zone II and Zone V flexor tendon injuries. American journal of physical medicine & rehabilitation. 2011;90(1):17-24.
5. Kingston GA, Williams G, Gray MA, Judd J. Does a DVD improve compliance with home exercise programs for people who have sustained a traumatic hand injury? Results of a feasibility study. Disability and rehabilitation: assistive technology. 2014;9(3):188-94.
6. Jack K, McLean SM, Moffett JK, Gardiner E. Barriers to treatment adherence in physiotherapy outpatient clinics: a systematic review. Manual therapy. 2010;15(3):220-8.
7. Shore JH, Aldag M, McVeigh FL, Hoover RL, Ciulla R, Fisher A. Review of mobile health technology for military mental health. Military medicine. 2014;179(8):865-78.
8. Neal J. Preferences for an exercise intervention using text messages with older veterans: an exploratory study [master's thesis on the Internet]. University of North Carolinal; 2016. Available from: https://cdr.lib.unc.edu/concern/dissertations/jh343t369
9. Adler AJ, Martin N, Mariani J, Tajer CD, Owolabi OO, Free C, et al. Mobile phone text messaging to improve medication adherence in secondary prevention of cardiovascular disease. Cochrane database of systematic reviews. 2017;(4):1-53.
10. Müller AM, Khoo S, Morris T. Text messaging for exercise promotion in older adults from an upper-middle-income country: randomized controlled trial. Journal of medical Internet research. 2016;18(1):e5.
11. McCoy P, Leggett S, Bhuiyan A, Brown D, Frye P, Williams B. Text messaging: an intervention to increase physical activity among African American participants in a faith-based, competitive weight loss program. International journal of environmental research and public health. 2017;14(4):326.
12. Fjeldsoe BS, Miller YD, Marshall AL. MobileMums: a randomized controlled trial of an SMS-based physical activity intervention. Annals of behavioral medicine. 2010;39(2):101-11.
13. Spark LC, Fjeldsoe BS, Eakin EG, Reeves MM. Efficacy of a text message-delivered extended contact intervention on maintenance of weight loss, physical activity, and dietary behavior change. JMIR mHealth and uHealth. 2015;3(3):e88.
14. Kingston GA, Tanner B, Gray M. A pilot study evaluating a home exercise DVD for patients who reside in a rural and remote location. Journal of rural and tropical public health. 2009;8:1-7.
15. Yeh M-L, Chen H-H, Liu P-H. Effects of multimedia with printed nursing guide in education on self-efficacy and functional activity and hospitalization in patients with hip replacement. Patient education and counseling. 2005;57(2):217-24.
16. Maddison R, Pfaeffli L, Whittaker R, Stewart R, Kerr A, Jiang Y, et al. A mobile phone intervention increases physical activity in people with cardiovascular disease: Results from the HEART randomized controlled trial. European journal of preventive cardiology. 2015;22(6):701-9.
17. Chan A-W, Tetzlaff JM, Altman DG, Laupacis A, Gøtzsche PC, Krleža-Jerić K, et al. SPIRIT 2013 statement: defining standard protocol items for clinical trials. Annals of internal medicine. 2013;158(3):200-7.
18. Moher D, Hopewell S, Schulz KF, Montori V, Gotzsche PC, Devereaux P, et al. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. Journal of clinical epidemology. 2010;63(8):e1-37.
19. Eysenbach G, Group C-E. CONSORT-EHEALTH: improving and standardizing evaluation reports of web-based and mobile health interventions. Journal of medical internet research. 2011;13(4):e126.
20. Duran R, Houser R. Controlled passive motion following flexor tendon repair in zones 2 and 3. In: Mosby C.V., editor. AAOS Symoposium on tendon surgery in the hand. St. Louis: 1975. p. 105-14.
21. Hassankhani GG, Moradi A, Vahedi E, Hoseinian SHS, Jahani Z, Rahmani M, et al. Psychometric properties of the Persian version of the patient rated wrist evaluation. Archives of bone and joint surgery. 2017;5(4):243.
22. MacDermid JC, Turgeon T, Richards RS, Beadle M, Roth JH. Patient rating of wrist pain and disability: a reliable and valid measurement tool. Journal of orthopaedic trauma. 1998;12(8):577-86.
23. Ebrahimzadeh MH, Moradi A, Vahedi E, Kachooei AR, Birjandinejad A. Validity and reliability of the Persian version of shortened disabilities of the arm, shoulder and hand questionnaire (quick-DASH). International journal of preventive medicine. 2015;6.
24. Beaton DE, Wright JG, Katz JN, Group UEC. Development of the QuickDASH: comparison of three item-reduction approaches. JBJS. 2005;87(5):1038-46.
25. Huskisson EC. Measurement of pain. The lancet. 1974;304(7889):1127-31.
26. The hand: examination and diagnosis. 3rd ed. American Society for Surgery of the Hand: Livingstone C; 1990.

27. Khonsari S, Subramanian P, Chinna K, Latif LA, Ling LW, Gholami O. Effect of a reminder system using an automated short message service on medication adherence following acute coronary syndrome. European journal of cardiovascular nursing. 2015;14(2):170-9.
28. Park LG, Howie-Esquivel J, Chung ML, Dracup K. A text messaging intervention to promote medication adherence for patients with coronary heart disease: a randomized controlled trial. Patient education and counseling. 2014;94(2):261-8.
29. Thakkar J, Kurup R, Laba T-L, Santo K, Thiagalingam A, Rodgers A, et al. Mobile telephone text messaging for medication adherence in chronic disease: a meta-analysis. JAMA internal medicine. 2016;176(3):340-9.
30. Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Atun R, Car J. Mobile phone messaging reminders for attendance at healthcare appointments. Cochrane database of systematic reviews. 2013;(12).
31. Antoine Parker C, Ellis R. Effect of electronic messaging on physical activity participation among older adults. Journal of aging research. 2016.
32. Kim BH, Glanz K. Text messaging to motivate walking in older African Americans: a randomized controlled trial. American journal of preventive medicine. 2013;44(1):71-5.