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Video-Based Exercise Applications for Patient Follow-up after Coronary Stenting: Protocol for a Feasibılity Study

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Abstract

Background: Cardiac rehabilitation (CR) is crucial for patients after coronary stenting, yet adherence remains low due to accessibility and logistical barriers. Video-based exercise applications may offer a feasible solution for remote patient follow-up.

Objective: This study protocol outlines a feasibility trial assessing the acceptability, safety, and preliminary efficacy of a video-based exercise intervention for post-stenting patients.

Methods: A single-arm feasibility study will be conducted with 30-50 patients who have undergone coronary stenting. Participants will engage in a 12-week video-based exercise program delivered via a mobile application, including structured aerobic and resistance training.

Results: Feasibility outcomes include recruitment rates, adherence, patient satisfaction, and safety (adverse events). Secondary outcomes include changes in functional capacity (6-minute walk test), quality of life (SF-36), and cardiovascular risk markers (lipid profile, blood pressure), sleep quality, anxiety, depression.

Conclusions: If feasible, this approach could enhance CR accessibility, particularly for patients with limited access to center-based programs. Findings will inform the design of a larger randomized controlled trial.

Keywords: Cardiac rehabilitation; Coronary stenting; Percutaneous coronary intervention (PCI); Exercise

Introduction

Percutaneous coronary intervention (PCI) with stenting has transformed the management of coronary artery disease, yet long-term outcomes remain dependent on effective rehabilitation [1]. Despite proven benefits, participation in traditional center-based cardiac rehabilitation (CR) remains critically low (20-30%), leaving a significant unmet need—particularly for rural, mobility-limited, or socioeconomically disadvantaged patients [2,3]. While digital rehabilitation solutions could bridge this gap, evidence on the efficacy and safety of video-based exercise programs tailored to PCI patients remains limited [4].

Remote monitoring is pivotal for enhancing postoperative adherence. Studies demonstrate that structured follow-up can improve treatment compliance by up to 40% and reduce hospital readmissions [5,6]. However, most existing digital rehab platforms rely on hybrid models (e.g., wearable devices + clinician feedback), with scant data on fully video-based, scalable solutions that could maximize accessibility without compromising safety [7,8].

For PCI patients, safety concerns regarding unsupervised exercise persist, particularly in the early recovery phase [9]. However, recent evidence suggests that appropriately designed remote interventions—with pre-recorded, intensity-modulated exercises and periodic monitoring—can be both safe and effective [10]. A feasibility study by Varnfield et al. (2020) showed high adherence and satisfaction among CAD patients using a smartphone-based CR program, though their protocol included real-time telehealth support [11]. Digital health interventions, such as video-based exercise programs, offer a scalable and accessible alternative to traditional center-based cardiac rehabilitation.

Coronary stenting patients often face barriers to attending center-based rehabilitation, highlighting the need for home-based alternatives like video-guided exercise programs [12]. In contrast, purely video-based applications, which are more scalable and cost-effective, remain understudied in this population.

This study aims to evaluate the feasibility and impact of a video-based exercise application for PCI patients.

We assume that a 12-week structured, video-assisted rehabilitation program, in accordance with the SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) guidelines, will produce the following results:

1. Achieve high adherence (>70% completion rate),
2. Demonstrate safety (major adverse cardiac event rate <1%), and
3. Significantly improve functional capacity (6-minute walk test) and quality of life (SF-36).

By addressing current evidence gaps in digital rehab for POST-PCI, these findings could inform scalable remote care models for underserved populations.

Methods

Study Type: Single-arm feasibility study.

Population: Patients undergoing coronary stenting:

Inclusion Criteria:

- Adults (≥18 years) with recent coronary stenting (≤3 months)
- Stable hemodynamics, no contraindications to exercise
- Smartphone/tablet access

Exclusion Criteria:

- Severe arrhythmias, uncontrolled heart failure
- Physical limitations preventing exercise

Participants will be asked to maintain their usual medical care and medication regimens as prescribed by their cardiologist throughout the study. Participation in any other structured cardiac rehabilitation program (center-based or other digital programs) will not be permitted during the 12-week intervention period.

Settings: Outpatient, remote follow-up.

Duration: 12-week intervention with baseline and post-intervention assessments

Intervention: Participants will receive a 12-week video-guided exercise program, prepared and video-recorded by a physiotherapist, that can be performed at home. The program includes:

Aerobic Training: 3 sessions per week, 30-40 minutes per session, at moderate intensity (Borg Perceived Exertion Rating 12-14/20 or 40-60% of heart rate reserve).

Resistance Training: 2 sessions per week, 20 minutes per session, using bodyweight or resistance bands for 8-10 major muscle groups (2 sets of 10-15 repetitions).

All sessions include a 5-minute warm-up and a 5-minute cool-down.

The exercise videos are pre-recorded and demonstrate correct technique. Participants will be contacted daily via mobile phone to remind them to perform their exercises along with the exercise videos. Participation will be monitored based on an exercise log.

Exercise Protocol:

Aerobic training (3×/week, 30-40 min, moderate intensity),

Resistance training (2×/week, 20 min),

Warm-up/cool-down sessions.

Monitoring: Weekly self-reports, remote vital sign tracking (if available).

Outcomes

Functional recovery, readmission rates, adherence, patient satisfaction, etc.;

Primary Feasibility Outcomes (at 12 weeks)

Recruitment rate: Proportion of eligible patients approached who consent to participate (aggregated as percentage with 95% CI).

- Adherence: Proportion of prescribed exercise sessions completed, defined as ≥80% of sessions logged in the app (aggregated as percentage with 95% CI).
- Safety: Incidence of exercise-related adverse events (e.g., falls, chest pain, arrhythmias) reported via weekly self-reports (aggregated as number and percentage).
- Patient satisfaction: Measured by a 5-point Likert scale satisfaction questionnaire at post-intervention (aggregated as median and IQR).

Secondary Efficacy Outcomes (change from baseline to 12 weeks)

- Functional capacity: Change in 6-minute walk distance (in meters).
- Quality of life: Change in SF-36 domain scores.
- Cardiovascular biomarkers: Change in LDL, HDL, and systolic/diastolic blood pressure (mmHg) (Table 1).

Data Management and Privacy

All participant data will be anonymized using unique study identification numbers. Personal identifiers will be stored separately from clinical data in a password-protected database accessible only by the principal investigator and authorized study personnel. Data collected via Google Forms will be transmitted via encrypted links and

Table 1: Participant Timeline.

Weeks	Tasks
Week -1 to 0	Screening, informed consent, and enrollment.
Week 0	Baseline assessments (6MWT, SF-36, lipid profile, blood pressure, sleep quality, anxiety/depression scales).
Week 1-12	Video-based exercise intervention (3 aerobic + 2 resistance sessions/week). Weekly self-reports of adherence and adverse events.
Week 12	Post-intervention assessments (all baseline measures repeated) and satisfaction survey.

*Assessments will occur at baseline (Week 0, pre-intervention) and post-intervention (Week 12).

stored in accordance with personal data protection regulations.

Sample Size Estimation

As this is a feasibility study, a formal power calculation was not performed. Instead, the sample size was determined based on recommendations for pilot/feasibility trials:

1. Primary Focus: To estimate recruitment rates, adherence, and safety parameters with adequate precision.
2. Target Enrollment: 30–50 participants, consistent with:

- The CONSORT extension for pilot trials (n=30–50 provides sufficient data to estimate variability for future RCTs). As this is a feasibility study with the primary aim of estimating parameters for a future RCT, a formal power calculation was not performed [13].
- The "rule of thumb" for feasibility studies (n≥30 allows estimation of proportions with 95% CIs spanning ±15–20%) [14].

Justification

- For adherence rates (primary outcome), a sample of 40 would yield a 95% CI of ±13% assuming 75% adherence [15].
- For safety (secondary outcome), n=50 permits detection of adverse events occurring at ≥6% frequency (with 95% probability) [16].

A larger sample was not pursued due to:

The exploratory nature of this technology assessment.

Resource constraints typical of feasibility studies.

Ethical Approval

This protocol will be submitted for ethical approval to an university's Faculty of Medicine Clinical Research Ethics Committee prior to participant recruitment.

Discussion

This feasibility study explores a novel, fully video-based exercise intervention for post-stenting patients—a significant innovation compared to hybrid telehealth models that require clinician feedback or wearable devices [17]. By leveraging pre-recorded, intensity-adjusted exercises delivered via mobile application, our design addresses two critical gaps in cardiac rehabilitation (CR): scalability (reducing reliance on specialized centers) and cost-effectiveness (minimizing real-time monitoring needs) [18]. The proposed model could particularly benefit rural and resource-limited settings where traditional CR access remains problematic [19].

However, several challenges merit consideration. First, digital inequities may limit participation among older adults or socioeconomically disadvantaged groups with limited smartphone access or technological literacy [20]. While our inclusion criteria require device ownership, this does not guarantee comfort with app-based interventions—a factor that will be closely monitored via patient satisfaction surveys. Second, sustained engagement without in-person supervision remains a concern; prior studies report attrition rates of 20–30% in fully remote CR programs [21]. Our adherence strategies (e.g., weekly reminders, progress tracking) aim to mitigate this, though long-term viability may require supplemental human support [22]. Finally, safety monitoring relies on patient self-reporting, which could delay detection of exercise-related adverse events. Future iterations might integrate wearable sensors for real-time vital sign monitoring [23].

Home-based telerehabilitation (HBCTR) post-PCI showed greater exercise capacity (48.20m vs. 34.77m in 6-min walk test, p=0.006) and quality of life (14.18 vs. 6.75, p=0.015) [24]. Telehealth-augmented cardiac rehabilitation resulted in significantly greater 6-month postoperative weight loss (13.8 ± 2.8 lbs vs. 7.8 ± 2.2 lbs) compared to standard programs [25]. Mobile health interventions incorporating medication reminders improved systolic blood pressure control ($p < 0.001$) and statin adherence ($p = 0.04$ at 60 days) [26]. No significant differences were found in depression scores between tele-rehabilitation and control groups at 6-week follow-up ($p > 0.05$). A nurse-led video intervention significantly reduced mean anxiety scores (MAS) from 60.88 to 33.08 pre-PCI ($p < 0.001$) and from 44.17 to 24.10 post-PCI ($p < 0.001$). [27]. No studies have yet been conducted on sleep quality in telerehabilitation.

Despite these limitations, this research could inform next-generation rehabilitation models in three key ways:

- Evidence for Policy Change: If successful, the results could support insurance reimbursement for video-based CR, expanding coverage to underserved populations [28].
- Hybrid Model Development: Findings will identify which patients benefit most from fully remote programs versus those needing blended (in-person + digital) care [29].
- Global Health Applications: The low-cost framework could be adapted for low/middle-income countries, where CR infrastructure is sparse but mobile penetration is high [30].

Future studies should compare video-based interventions to standard CR in larger randomized trials, with longer follow-up to assess cardiovascular outcomes.

Conclusions

If feasible, this approach could enhance CR accessibility, particularly for patients with limited access to center-based programs. Findings will inform the design of a larger randomized controlled trial.

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