

Early strength training using theraband exercises for phase-1 cardiac rehabilitation in a patient with a fractured femur: a case report

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The effectiveness of exercise-based cardiac rehabilitation (CR) following an acute coronary syndrome (ACS) is well established. However, ACS complicated by an orthopedic limitation, poses greater challenges to early mobilization. Thus, there is a need for an alternative rehabilitation approach to improving exercise capacity and in preventing and reducing associated complications during convalescence. This case report highlights the value and utility of using low level resistance exercises to the upper limb with theraband exercise during an inpatient or phase-1 CR program. A low intensity theraband regimen for the upper limb was administered based on the number of repetitions performed to fatigue. The functional improvements observed and the ability of the patient to tolerate the therapy suggests a potential role for theraband exercises in phase-1 CR in ACS patients with selected orthopedic limitations.

Keywords:

angina, coronary artery disease, resistance exercise, theraband

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Introduction

Cardiac rehabilitation (CR) in India is evolving, with most programs focused on early ambulation [1]. Currently, participation in an exercise-based CR program is more likely after coronary artery bypass graft surgery as compared with acute myocardial infarction, percutaneous coronary intervention, or both [1]. However, a significant number of patients entering these CR programs are elderly with various comorbid conditions. Current exercise recommendations for CR primarily include aerobic and resistance training [2]. Considering the patient's age and related musculoskeletal conditions, traditional exercise training methods may not be applicable during the varied stages of CR.

This case report describes an upper limb resistance training program using theraband in a patient who was unable to participate in a conventional exercise-based CR intervention due to severe musculoskeletal limitations.

Case history

A 63-year-old woman presented with progressive dyspnea and angina 2 days after undergoing dynamic hip screw (DHS) fixation for a fractured femur. She had a 40-year history of type 2 diabetes mellitus and was taking oral hypoglycemic agents. Her resting ECG revealed ST segment elevation acute myocardial infarction involving

the inferior wall and complete heart block. Echocardiography revealed an ejection fraction of 69%, end diastolic volume of 124 ml and end systolic volume of 43 ml with a hypokinetic inferior wall. She underwent an emergent coronary angiogram and angioplasty of the right coronary artery culprit lesion (90% occlusion); in addition, a temporary pacemaker was inserted through the right femoral vein. The temporary pacemaker was maintained with leg immobilization for 1 week, allowing her complete heart block to revert to normal sinus rhythm. Subsequently, she was referred to physiotherapy for CR. Because of her DHS fixation, traditional ambulation as part of the CR program was severely limited. In view of the reduced mechanical efficiency and greater energy expenditure anticipated with the afflicted leg, it was decided to provide upper limb exercise using theraband complemented by adjunctive active exercises for the lower limb. The patient consented to this treatment strategy and support from the referring physician was obtained.

Examination

The patient was evaluated on the day of referral. Her vitals were stable, she was asymptomatic, and her

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cardiovascular examination was unremarkable. A musculoskeletal examination revealed right hip pain which was 7/10 on the numeric pain rating scale, with a limited range of movement. Using goniometry range of motion, right hip flexion with knee flexion and hip abduction were 0–45° and 0–50°, respectively. Manual muscle testing of lower limbs was not performed due to the pain associated with the DHS fixation. The left lower limb was normal.

Intervention

Training included shoulder flexion, abduction and horizontal abduction exercises with a yellow theraband, five repetitions per day, and gradually progressed based on Borg's rating of perceived exertion scale (RPE) between 11–13/20 ('fairly light' to 'somewhat hard') to 10 repetitions each day for the initial 4 days; subsequently, a red theraband was used for days 7–15. The theraband intervention program is summarized in Table 1, with specific reference to resistance, frequency, repetitions, and RPE over time. All exercises were performed under the supervision of a physical therapist and vitals were monitored during the activity sessions. An assistive device (i.e. walker) was used to facilitate her hospital ambulation. In addition to upper limb exercises, mobilization of the operated leg and lower limb strengthening were also initiated and progressed.

Outcome measures

Following 7 days of treatment, a 6-min walk test (6MWT) and performance-based tests for the upper limb were obtained on the patient. The 6MWT was conducted as per previously published guidelines but with an aid of a walker [3]. Performance-based testing was developed for this unique case to assess functional status in this patient who could not undergo conventional submaximal exercise testing due to significant musculoskeletal limitations.

The test involved performing a maximum number of repetitions in 1 min to fatigue, using the large muscle groups of the upper limb, that is, shoulder flexion and shoulder abduction. Fatigue was assessed using a numeric rating scale which has been previously validated [4].

On the eighth day of her hospital stay, the patient developed acute renal failure and fluid overload, which was successfully medically managed. CR was temporarily halted during this time and resumed, once again, when she was clinically stable, using low intensity exercises with a red theraband, active exercises for lower limb and walking with the aid of a walker. After 15 additional days, the battery of functional tests were readministered. Despite the episode of acute renal failure, the patient responded favorably to the theraband program and regular exercise-based CR, and improved functionally, with no adverse events.

The patient's functional performance improved and her fatigue lessened. A summary of musculoskeletal performance measures before and after CR are shown in Table 2. Fatigue, assessed using the numeric rating scale, improved by 50% from day 7–17. Performance-based tests showed increases in shoulder flexion and abduction by 51 and 24%, and 48 and 27% for the right and left upper extremities, respectively. At day 7, the patient was unable to perform a 6MWT due to excessive fatigue. However, following the 17 day rehabilitation intervention, she was able to walk 11 m in 2.5 min with the aid of a walker.

Discussion

Current CR recommendations allow for light resistance training (1–3 lbs) for inpatient CR which could be initiated with hand weights for up to 1 h/week with

Table 1 Theraband intervention program

	Day 1–2	Day 3–4	Day 7	Day 8–11	Day 12–13	Day 14–15
Resistance	Yellow	Yellow	Red	CR program was stopped due to acute renal failure and fluid overload	Red	Red
Frequency (sessions/day)	2	2	2		1	2
Repetitions	5	10	10		10	10
RPE	11–13	11–13	11–13	–	11–13	11–13

CR, cardiac rehabilitation; RPE, Borg's categorical rating of perceived exertion (6–20 scale).

Table 2 Selected musculoskeletal performance measures before and after cardiac rehabilitation

Performance-based test	Day 7		Day 17		% improvement	
	Right	Left	Right	Left	Right	Left
Shoulder flexion (maximum number of repetitions in 1 min)	18	19	37	25	51%	24%
Shoulder abduction (maximum number of repetitions in 1 min)	13	16	25	22	48%	27%

weight loads allowing 10–15 repetitions/set [3,5]. Despite these recommendations, the timing at which the muscular strength/endurance program should be initiated remains unclear with one position paper suggesting resistance training as early as 7 days after an acute cardiac event [6].

Theraband exercises have been reported to improve muscular strength, balance and cardiorespiratory function [7]. These elastic resistance devices have been found to elicit similar peak muscle activity with higher RPE when compared with traditional strength training devices [8]. Despite these benefits, the use of theraband as a resistance training modality in phase-1 CR has not been previously reported. A theraband exercise program guided by RPE was used previously along with music for persons with hemophilia [9]. An intensity of 11–13 on the RPE 6/20 category scale, corresponding to 'fairly light' to 'somewhat hard' exertion, has been recommended as an adjunctive intensity modulator in deconditioned individuals [10]. Therefore, this intensity was used to guide the CR program for the present patient.

Improvements in functional performance in our 63-year-old female patient suggest the potential for theraband-based CR for selected patients requiring CR but with coexisting musculoskeletal conditions. The authors acknowledge the limitations in accurately measuring outcomes for upper limb function; however, this approach may have value for selected phase-1 CR patients. Nevertheless, additional studies are needed to further substantiate the potential value of theraband-based CR.

Conclusion

This case report highlights the value and utility of employing low level resistance exercises to the upper limb using theraband as part of an exercise-based CR program. The ability of our patient to effectively employ these exercises suggests the potential role for theraband in phase-1 CR. Because ambulation was severely limited in

this patient, upper limb exercises to maintain and enhance functional status during hospitalization were used, serving as a gateway to conventional CR. Innovative program modifications according to individual patient needs may help in augmenting exercise capacity and in preventing and reducing fatigue and musculoskeletal atrophy associated with heart disease.

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Conflicts of interest

There are no conflicts of interest.

References

- Madan K, Babu AS, Contractor A, Sawhney JP, Prabhakaran D, Gupta R. Cardiac rehabilitation in India. *Progress Cardiovasc Dis* 2014; 56:543–550.
- Fletcher GF, Ades PA, Kligfield P, Arena R, Balady GJ, Bittner VA, *et al.* American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee of the Council on Clinical Cardiology, Council on Nutrition, Physical Activity and Metabolism, Council on Cardiovascular and Stroke Nursing, and Council on Epidemiology and Prevention. Exercise standards for testing and training: a scientific statement from the American Heart Association. *Circulation* 2013; 128:873–934.
- ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS statement: guidelines for the six-minute walk test. *Am J Respir Crit Care Med* 2002; 166:111–117.
- Nicklin J, Cramp F, Kirwan J, Greenwood R, Urban M, Hewlett S. Measuring fatigue in rheumatoid arthritis: a cross-sectional study to evaluate the Bristol Rheumatoid Arthritis Fatigue Multi-Dimensional questionnaire, visual analog scales, and numerical rating scales. *Arthritis Care Res (Hoboken)*. 2010; 62(11):1559–1568.
- American Association of Cardiovascular and Pulmonary Rehabilitation. Guidelines for cardiac rehabilitation and secondary prevention programs. 4th ed. Champaign, IL: Human Kinetics 2004.
- Piepoli MF, Corrà U, Benzer W, Bjarnason-Wehrens B, Dendale P, Gaita D, *et al.* Secondary prevention through cardiac rehabilitation: from knowledge to implementation. A position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation. *Eur J Cardiovasc Prev Rehabil* 2010; 17:1–17.
- Patterson RM, Stegink Jansen CW, Hogan HA, Nassif MD. Material properties of theraband tubing. *Phys Ther* 2001; 81:1437–1445.
- Jakobsen MD, Sundstrup E, Andersen CH, Persson R, Zebis MK, Andersen LL. Effectiveness of hamstring knee rehabilitation exercise performed in training machine vs. elastic resistance: electromyography evaluation study. *Am J Phys Med Rehabil*. 2014; 93:320–327.
- Babu AS, Balthillaya GM, Navada R, Kurien A. Theraband® exercises with music for persons with haemophilia. *Haemophilia*. 2013; 19:e358–e359.
- Scherr J, Wolfarth B, Christle JW, Pressler A, Wagenpfeil S, Halle M. Associations between Borg's rating of perceived exertion and physiological measures of exercise intensity. *Eur J Appl Physiol* 2013; 113:147–155.