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Evaluation of the acceptability of a sphygmomanometer device in knee extension training following surgical procedures of the knee

Hauke Horstmann [a, *], Christian Colcuc [b], Philipp Lobenhoffer [c], Christian Krettek [d], Thomas Sanjay Weber-Spickschen [a]

[a] Institute of Sports Medicine, Hannover Medical School, Carl-Neuberg-Str. 1, 30625 Hannover, Germany
[b] Trauma Department, Evangelisches Krankenhaus Bielefeld, Burgsteig 13, 33617 Bielefeld, Germany
[c] Gelenkchirurgie Orthopädie Hannover, Uhlemeyerstraße 16, 30175 Hannover, Germany
[d] Trauma Department, Hannover Medical School, Carl-Neuberg-Str. 1, 30625 Hannover, Germany

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ABSTRACT

Background: The postoperative treatment after a standard surgical intervention such as knee arthroplasty, proximal tibial osteotomy or supracondylar osteotomy, can have an important impact on the overall treatment outcome. In most cases, outcomes are positively effected by patients receiving physiotherapy and occupational therapy. Basic movements and range of motion need to be learnt. Self-responsible behaviour, which is similar to exercise programs in sports, needs to be supported. However, in most cases the transfer of training techniques into successful and desired postoperative care is not simple. A training technique needs to be developed which is self-explanatory, effective, encouraging for and accessible to the patient.
Objectives: The purpose of this study was to describe and evaluate an easy and effective technique to support regular physiotherapy in early postoperative rehabilitation using a sphygmomanometer device. Measurements were undertaken relating to handling, training results and motivation.
Design: This was a descriptive study.
Methods: Forty one patients were instructed to undertake extension exercises of the knee in the early postoperative phase. A sphygmomanometer cuff was rolled out and placed just below the popliteal fossa, and inflated to 20 mmHg. In this position the patients were prompted to push the knee down with the maximum available power. The quadriceps muscle of the leg is activated when patients extend the knee using two thirds of their maximum power, and then followed by one third of their maximum power. This exercise sequence was carried out three times for 5 seconds. The results were documented by using a patient questionnaire.
Results: Thirteen patients indicated that they felt highly motivated while undertaking the training program. One patient reported poor motivation due to inconvenient handling (preparing the cuff by closing the valve screw or calculating the target value) and six patients reported that the method of handwritten recording of training sessions needed to be improved. There were no technical problems. The training results were rated as being predominantly good. Due to the variation in individual ability in extending the knee, comparison of the overall values obtained could not be done.
Conclusion: The use of a sphygmomanometer device is cheap and feasible technique in postoperative independent knee extension training.

1. Introduction

Arthrogenic muscle inhibition is the main cause of post-traumatic quadriceps weakness (Hopkins and Ingersoll, 2000). Arthrogenic muscle inhibition is an ongoing neural activation deficit of the quadriceps muscle after knee injury, knee joint arthritis or knee surgery (Rice et al., 2014). It is essential that full knee extension and quadriceps muscle activation can be achieved at the initial stage of knee rehabilitation (Park et al., 2012). However, most patients are reluctant or poorly motivated to undertake

* Corresponding author.
E-mail address: horstmann.hauke@mh-hannover.de (H. Horstmann).

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their knee rehabilitation early for several reasons. These factors include persistent pain in and swelling of the knee, bulky wound-dressings, presence of operative drains that limit knee movement, or lower limb weakness after spinal anaesthesia and peripheral nerve block (Holm et al., 2010; Mizner et al., 2005). Physiotherapists can sometimes have difficulties building up a good and sustainable working rapport with patients as a result of postoperative pain and patient uncertainty at the beginning of the rehabilitation program. (Specht et al., 2015; Thomsen et al., 2013).

After a standard surgical intervention, postoperative treatment has a significant impact on the overall treatment outcome. In most cases this is effected by patients receiving physiotherapy and occupational therapy. Basic movement behaviours as well as improvement in the range of motion of the affected joints need to be undertaken and learnt by patients. But the early postoperative situation can negatively affect the usual motivation pattern of patients, and an internal locus of control is crucial for effective rehabilitation (Kendell et al., 2001). In the early postoperative rehabilitation period, most patients feel insecure about their competence and autonomy, two of the three innate psychological needs of self-determination theory (Ryan and Deci, 2000b). As a result, intrinsic motivation is reduced, increasing the importance of cautious implementation of external motivation (Ryan and Deci, 2000a). The sphygmomanometer device is a tool that provides external stimulus.

Self-dependent behaviour, such as that required in exercise programs, needs to be supported. However, in most cases the transfer of training techniques into successful postoperative care is not simple (Mikkelsen et al., 2016). Uncertainty on given limits are an issue. Therefore, a self-explanatory, effective, encouraging and accessible technique for knee extension exercises and training is needed.

A training technique for knee extension with a sphygmomanometer device was developed to help patients achieve full knee extension range and avoid quadriceps muscle atrophy immediately after knee injuries or other procedures involving the knee. Patients can undertake rehabilitation with this technique in addition to regular physiotherapy programs at any time during their hospital stay (Jakobsen et al., 2012). Through this technique, self-dependent behaviour can be encouraged, aiming to augment the postoperative recovery period, shorten hospital stay and reduce hospital costs. The aim of this study was to evaluate the feasibility of this technique and the patient's acceptability and response towards this new tool.

2. Methods

2.1. Technique

The whole technique and rationale was explained in detail to the patient and an explanatory leaflet was given to the patient before the start of the process. In using the sphygmomanometer device to monitor knee extension, the patient was asked to lay or sit on a flat surface such as the examination couch. The sphygmomanometer cuff was placed under the knee (Fig. 1). The sphygmomanometer was inflated to about 20 mmHg (Fig. 2). The patient was then asked to try to extend the knee by pressing the knee down on the sphygmomanometer cuff to increase the pressure on the cuff. The patient was instructed to maintain the pressure for a few seconds before releasing it to the initial position.

2.2. Training

Once the sphygmomanometer cuff had been placed under the knee in the starting position, the patient was instructed to push their knee down against the sphygmomanometer cuff as strongly as possible (Fig. 3). The peak pressure shown on the sphygmomanometer gauge was documented. The patient then took a 1-minute break while maintaining the initial position with the knee in a relaxed position on the sphygmomanometer cuff at a pressure of 20 mmHg. To improve the coordination, capability the patient was instructed to repeatedly extend the knee as described above.

In the next training phase, the patient was asked to extend the knee down against the sphygmomanometer cuff using two thirds of their maximum power. This pressure had to be maintained in the upper range between the starting pressure of 20mmHg and to maintain this peak value for 5 seconds. Subsequently, the pressure was then released to a lower pressure between 20 mmHg and the

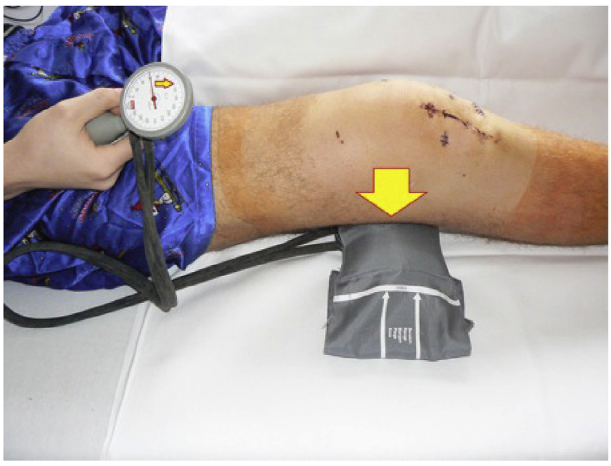

Fig. 1. Exercise start position

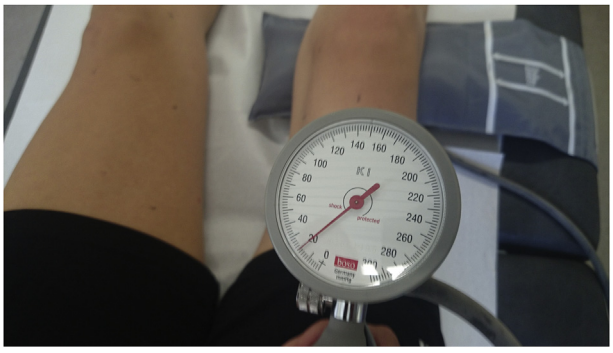

Fig. 2. Initial position (20mmHg)

Fig. 3. Individual peak power measurement