Effectiveness of device-based therapy for conservative management of low back pain

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Abstract. [Purpose] Device based therapy for low back pain (LBP) involves quantitative assessment of muscle strength, resistance and lumbar motion and tailoring the rehabilitation protocol based on this objective assessment. The purpose of this study was to determine the effectiveness of device based therapy for LBP. [Subjects and Methods] In this retrospective study, clinical data of 235 patients who underwent device-based physiotherapy for low back pain was reviewed. Pre and post-treatment outcome measures for pain (visual analogue scale or VAS score), disability (Oswestry disability index) and functional ability were compared to determine effectiveness of device-based physiotherapy at the end of 6 weeks of treatment. [Results] All outcome measures including VAS Score and mean Oswestry Disability Score showed significant improvement at the end of 6 weeks of device-based physical therapy. Before treatment, 73% of patients had moderate to severe disability which reduced to 28% after treatment. [Conclusion] Device-based therapy is effective in relieving pain, improving function and reducing disability in patients with low back pain in the short term. Device-based therapy may help to objectively evaluate the function of the spine and paraspinal muscles and help the therapist tailor treatment accordingly.

Key words: Low back pain, Device-based therapy, Disability

INTRODUCTION

Low back pain (LBP) is one of the commonest musculoskeletal complaints and cause for disability globally1). Conservative treatment or non-operative management which includes physiotherapy is the main stay of treatment for non-specific back pain whereas surgery is reserved for patients who have not shown any improvement with conservative management or in those where specific causes for the back pain or radicular pain has been identified2–4).

Physiotherapy has been reported to be effective in relieving LBP and involves a multidisciplinary approach aimed at regaining function and preventing disability2–5). Physiotherapy regimes for management of LBP are varied and include McKenzie lumbar spine exercises, intensive strengthening, manipulation, device-based therapies, and low intensity aerobics5–9). Device based therapy for LBP involves quantitative assessment of muscle strength, resistance and lumbar motion and tailoring the rehabilitation protocol based on this objective assessment.

Although several reports have analysed the effectiveness of standard physiotherapy for LBP, literature is lacking in terms of effectiveness of device based therapy for LBP. To the best of our knowledge, there are no studies in the literature which have reported effectiveness of device based therapy for LBP. Hence, the purpose of this study was to determine the effectiveness of device based therapy for LBP.

SUBJECTS AND METHODS

We retrospectively reviewed the clinical records of patients treated for low back pain (LBP) using device-based physical therapy during a 1 year period between March 2013 and March 2014. The inclusion criteria were device-based physical therapy done for patients with low back pain where red flags (Fever, Recent trauma, Pain at night or at rest, Progressive motor or sensory deficit, Saddle anaesthesia, Unexplained weight loss, History of cancer or strong suspicion of cancer, History of osteoporosis or chronic steroid use, Immunosuppression, Failure to improve after 6 weeks of conservative therapy) were ruled out using clinical history, examination and magnetic resonance imaging (MRI)10, 11). The exclusion criterion was incomplete clinical records where demographic and clinical outcome data could not be obtained. Based on the inclusion criteria, clinical records of 250 patients were available for review. Fifteen patients had to be excluded due to incomplete records leaving 235 patient records for analysis.

Before induction into therapy, every patient underwent detailed assessment by a therapist which included taking...
down detailed history, a thorough clinical examination and review of their MRI report. Demographic details such as age, gender, height, weight, body mass index (BMI), and lifestyle and clinical history details such as duration of back pain, number of previous episodes, past history of trauma or surgery, pain radiation was obtained from the clinical records. The clinical examination included assessment of posture, lumbar spine movement loss and flexibility, neurological and motor/myotome examination. Pain before and after treatment was recorded using the Visual Analogue Scale (VAS) system. Functional disability before and after treatment was recorded using the Oswestry low back pain disability score\(^{(12)}\).

The device-based physical therapy program followed a standardised protocol including 18 sessions spread over 6 weeks. The program was provided by physiotherapists based at 2 centres. The program began with pain control regime combined with the McKenzie lumbar spine exercises. The purpose was to reduce the pain so that the patient can then be put on the device for objective assessment of lumbar spine movement loss and flexibility and paraspinal muscle strength and endurance using the David Spine Concept system (David Health Solutions, Helsinki, Finland). This machine is equipped with a knee-lock system and a thigh-restraining belt to immobilize both hips and thighs which allowed the patient to move only the lower back. The patient was then put on a customised protocol based on the readings of the device which was plotted on a graph called the Digital Spine Analysis (DSA) Graph. The program aimed to increase both strength and endurance of the back/paraspinal muscle with 15 to 20 repetitions every session on the device. If the patient was able to perform more than 20 repetitions of slow and controlled back extension and flexion movements, 2–2.5 kg was added in the next training session. However, if the patient was able to perform less than 15 repetitions, the training load was lowered by 2–2.5 kg next time. Post treatment outcome measures such as VAS Score, Oswestry Score and category and Functional ability were all recorded after completion of 6 weeks of physical therapy.

The pre and post treatment (at the end of 6 weeks of device-based therapy) outcome measures of VAS Score, Oswestry Score and Functional ability were compared using the Student’s t-test for continuous data and Fisher’s exact test for categorical data. A p value of <0.005 was considered significant.

RESULTS

There were 142 male patients and 93 female patients with a mean age of 44±13.8 years (range, 17–84 years) and a mean BMI of 26.5±4.3 (kg/m\(^2\)). One hundred and seventy-two patients reported to lead a sedentary lifestyle and 63 patients had a semi-active to active lifestyle. The duration of low back pain ranged from days to years and the most common lumbar spine level affected on MRI was L4-S1 level. The common pathological changes reported on lumbar MRI included disc bulge, disc protrusion, disc herniation, facetal arthropathy, spondylolisthesis and canal stenosis.

All outcome measures showed significant improvement at the end of 6 weeks of device-based physical therapy. Low back pain as measured by the mean VAS score reduced significantly from 4.8 to 0.6 (p=0.0001) whereas the mean Oswestry score improved from 39 to 15.3 (p=0.0001) after treatment. Before treatment, 73% of patients had moderate to severe disability owing to their low back pain whereas after treatment this number dropped down to 28%. Similarly, the functional ability to perform daily tasks such as sitting (33% vs. 85%), standing (31% vs. 81%) and walking (29% vs. 85%) also improved significantly after treatment (p=0.0001).

DISCUSSION

The current study sought to determine the effectiveness of device-based physical therapy for treatment of low back pain. Patients in our study showed significant reduction in VAS Score for pain and Oswestry disability score and improvement in functional ability thus confirming that device-based therapy is quite effective in relieving pain, improving function and reducing disability in patients with low back pain in the short term.

The David Spine Concept system (David Health Solutions, Helsinki, Finland) used in this study acts as a diagnostic tool and allows the therapist to determine functional deficit of the lumbar spine which includes restriction of lumbar motion and strength of the paraspinal muscles. Hence, this device-based protocol helps the therapist to identify functional deficits in each individual and tailor his treatment accordingly.

Literature is lacking for reports on the effectiveness of device-based therapy for conservative management of low back pain. Helmhout et al.\(^{(12)}\) conducted a randomised control trial in military recruits to determine the effectiveness of device-supported specific lumbar extensor training compared with regular physical therapy in subjects with nonspecific, nonacute LBP. They reported that device-supported specific back strengthening did not offer greater benefits when compared to routine physiotherapy in the treatment of LBP\(^{(12)}\). However, their study population had stricter inclusion criteria and had recruits with similar background whereas our study population showed greater variability in terms of age, gender and lifestyle. Furthermore, the device-supported therapy used in the study by Helmhout et al.\(^{(12)}\) involved specific lumbar extensor strengthening only unlike the treatment protocol in our study which was varied based on variability in strength, motion and function as highlighted by the David Spine Concept system.

There are a few limitations to our study. First, the retrospective design of this study has its own limitations and inherent biases. Second, the results reported are at the end of 6 weeks of therapy and the long term implications or effectiveness of device-based therapy in the management of LBP is not known and needs to be studied further. Finally, a well-designed, prospective randomised trial needs to be undertaken to further confirm the benefits and advantages of device-based therapy over regular physiotherapy for the conservative management of LBP.

In conclusion, device-based therapy is quite effective in relieving pain, improving function and reducing disability in patients with low back pain at the end of 6 weeks of therapy.
Device-based therapy may help to objectively evaluate the function of the spine and paraspinal muscles and help the therapist tailor treatment accordingly.

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