ORIGINAL ARTICLE

Nr 2022;12 (2):181-190

Global Postural Re-Education is More Effective than Motor Control Exercises in patients with Non-Specific Low Back Pain

A. Kumar

Department of Physiotherapy, Swarnim Startup and Innovation University, Gandhinagar, Gujarat, India

CORRESPONDING AUTHOR:
Arvind Kumar
Department of Physiotherapy
Swarnim Startup and Innovation University
I-403, Umiyateerth Ville
Near Gayatri Temple, Kalol-382721
Gandhinagar, Gujarat, India
E-mail: drarvindmpt@gmail.com

DOI:
10.32098/mltj.02.2022.12

LEVEL OF EVIDENCE: 1B

ABBREVIATIONS:
GPR: Global Postural re-education
MCE: Motor control exercises
LBP: Low back pain
MOLBPDI: Modified Oswestry Low back pain Disability Index
NPRS: Numerical pain rating scale
FFT: Fingertip to floor test
NSLBP: Non-specific low back pain
CNS: Central nervous system
LBA: Low back ache
PAR-Q: Physical activity readiness-questionnaire
SPSS: Statistical package for social sciences

SUMMARY

Background. LBP is one of the major problems in a primary care communal illness with a lifetime prevalence estimating to be as high as 84%. The unspecified structural problems can ascend from day to day mechanical and postural stress on the spine and its related ligaments and muscles. It is associated worldwide with vast amounts of expenditure in terms of direct health care and losses in relation to disability. Currently, there has been a huge focus on physical exercises intended to enhance segmental motion control and lumbar spine stabilization.

Methods. The study sample comprises a total of 239 patients with non-specific LBP. From the sample population, a total of 100 patients were evaluated to GPR based intervention therapy and the 100 patients evaluated with MCE based intervention therapy after dropout. After the end of the intervention procedure the following were evaluated: pain level by numeric pain rating scale, disability by Modified Oswestry Low back pain Disability Index and functional status by fingertip to floor test. The frequency of the session performed in both groups were three times in a week over the study period of five weeks

Results. While comparing the evaluated report pain intensity was effectively reduced in both study groups ($p < 0.001$). The GPR group effectively reduced pain intensity at the end of the intervention compared to the MCE group ($p < 0.001$). The Modified Oswestry Low back pain Disability Index reduced in both groups; however, the GPR Group more significantly reduced the score compared to MCE Group ($p < 0.001$). Fingertip to Floor test showed that the GPR Group had a significantly higher flexibi - ity than the MCE Group ($p < 0.001$).

Conclusions. Patients allocated to the GPR group showed significant improvement in functional status, disability and pain intensity as compared to the MCE group ($p < 0.001$) in patients with nonspecific low back pain

KEY WORDS

Global postural reeducation; disability; motor control exercises; numerical pain rating scale; non-specific low back pain; lumbar stabilization

BACKGROUND

Low back pain (LBP) is one of the most common illnesses with a lifetime prevalence estimating to be as high as 84% (1). The definition of LBP defined as stiffness in the lower back under the costal margin or muscle tension and above the inferior gluteal folds, without or with leg pain (2). Low back pain is found to be one of the foremost causes of health problems worldwide. The prevalence of low back pain differs from 5-65%. It has been reported that the 90% of LBP related to unspecified causes (2)

The lumbar region of back pain which lasts for 4 weeks and more has not been diagnosed as a specific disease or spinal

abnormality is termed as NSLBP (3). It has been reported that the weakened abdominal, back muscles, poorly stretched muscles, incorrect posture, obesity, strained muscles from incorrect body mechanics which often results in the NSLBP pain (4). Lower levels of physical fitness and shorter duration of sitting activities at home may be associated with reduced extensor muscle endurance instead of long duration sitting posture in nonspecific chronic LBP (5)

It has been observed that there are many physiotherapy therapeutic approaches including therapeutic electric stimulation currents, and exercises of CNLBP have been evolved as one most effective therapeutic approach, focus on maintaining spine stability (6, 7). Core stability exercises with neuromuscular electric stimulation was shown to reduce pain and improve the function and stability of the lumbopelvic complex (8).

Motor control exercise was advanced based on a perception that persons with LBP showed some variations in control and coordination of spine muscles. Lumbar muscles must have enough strength and endurance to meet the demands needed for control of spine, but the accuracy and efficacy of the muscular system is controlled by the CNS (9). The CNS must interpret continuously the status of stability and movement, then plan mechanisms and rapidly initiate appropriate activity in response to overcome unexpected challenges. Many studies have shown that low back pain patients may exhibit a delayed onset of activity of the deep spine muscles (10, 11). In summary, the evidence seems to suggest that, with LBP, there is an alteration in control of the deep intrinsic spinal muscles that consistently manifests as hypoactivity. Although others argue that paraspinal muscles react to pain and injury with hyperactivity (12-14).

MCE emphasis on stimulation of deep spine muscles (*i.e.*, transverse abdominals and multifidus), pointing reinstatement of control and synchronization of this muscle (15).

GPR is based on an assimilated awareness of muscular schema as shaped by muscle chains, which can facade lessening resultant from legitimate, behavioral, and psychological features. The intention of GPR is to expand the shortened muscles by means of creep property of viscoelastic tissue and to enhance contraction of the antagonist muscles, thus avoiding postural asymmetry (16).

Two randomized controlled trials showed that GPR was more effective than analytic stretching and mobilizing exercises in improving clinical and functional measures (18). Available studies do not provide sufficient evidence for exact conclusions. This study compared the effectiveness of Lumbopelvic Stabilization Exercises and McKenzie Method in Low Back Pain and found that both techniques were efficient in reducing pain and improving function in patients with low back pain due to disc protrusion. However, the groups that used stabilization exercises showed better results in activating lumbopelvic stabilizing muscles (19). The present study compared the effectiveness of GPR and MCE on nonspecific low back pain patients

MATERIALS AND METHODS

Design of the study

The study design incorporated in the following research is "Experimental Study". The study was conducted at the USB college of Physiotherapy of the Rajasthan University of Health Sciences, Rajasthan, India from January 2013 to December 2019. The study was approved by the USB Institutional Ethics Committee of the USB Group of colleges under Ref. no. USB/Ethical/21, dated: 06/01/2013. The study meets the ethical standards of the Helsinki protocol.

Sampling and randomization

Three hundred two patients were initially selected and included in the study for baseline evaluation. During evaluation sixty-three were excluded because forty-four did not meet inclusion criteria and nineteen chosen not to participate in the study. Therefore, remaining two hundred thirty-nine were concluded the study.

Two hundred thirty-nine patients were randomly allocated to the MCE group (n = 123) and GPR group (n = 116) by an independent researcher by means of sealed envelopes containing the group name. Twenty-three patients dropout from MCE group and sixteen patient dropout from GPR group. Finally, hundred patients were completed study and analyzed at the end of intervention in both group (**figure 1**).

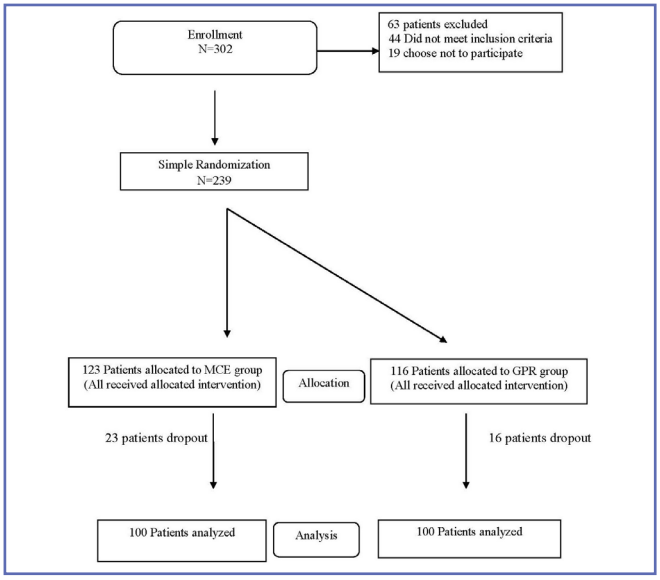

Figure 1. Study Flow Chart.

Eligibility criteria

Inclusion criteria were aged 18 years or above for both genders suffering from non-specific LBP for more than 4 weeks and willing to participate in the study.

Exclusion criteria were the LBP less than 4 weeks (acute LBP), specific LBP caused due to previous/existing medical conditions such as disc herniation, lumbar stenosis, spinal deformity, fracture, spondylolisthesis, neurologic signs (both central/peripheral), systemic illness such as rheumatologic diseases and tumor, psychiatric/mental deficits, patients who had a previous surgical history (within 6 months) were also excluded prior to the baseline assessment.

Evaluation protocol

The baseline evaluation was performed initially prior to randomization and at the end of the intervention in both the group. Evaluator had more than 10 years of experience with the evaluation tools used in the study. Selected modules of physical fitness, anthropometric measurements (height, weight and finall , the BMI), and physiological variables were taken from each subject

The PAR-Q self-screening tool used before starting any intervention either MCE or GPR group for safety or possible risk of exercising for an individual based on their health history, and current symptoms and risk factors.

Outcome measures of the study were subjected to objectively determining the patient's baseline function at the beginning of intervention period, for evaluating the intervention's/treatment's end outcome. The outcome measures employed in the following study were: Modified Oswestry Low Back Pain Disability Index (MOLBPDI), Numeric Pain Rating Scale (NPRS) and Fingertip to Floor Test (FFT). Pain analysis was done using the Numeric Pain Rating Scale (NPRS).Moreover, functional status and disability were evaluated through the Modified Oswestry Low Back Pain Disability Index (MOLBPDI) and Fingertip to Floor Test (FFT).

Intervention protocol

Each session of the intervention lasts up to one hour with one-to-one supervision to avoid unnecessary complication while undergoing intervention procedure by the sample patients. The frequency of the sessions performed three times in a week, with each session being distributed on an even scale, over the study period of five weeks, totaling 15 intervention sessions in both the group.

Group A: the Motor Control Exercise (MCE) Intervention Group

The sample populations belonging to Group-A received the MCE program. The intervention procedure incorporated numerous preparatory exercises prior to intervention procedure. The interventions started immediately after the baseline evaluation. Each individual belonging to the group was suggested to rehearse the proposed exercises that were taught by the researcher in their previous physical therapy session. The patient must perform the proposed exercise at home every day for 15 minutes. The holding time and the number of repetitions performed were increased progressively (increased up to 10 contraction repetitions × 10-second duration for each exercise).

The patients were taught and instructed how to contract trunk muscles. The patient was instructed to perform a slow and normal breathing while performing the intervention and while activating/holding muscular contraction in each step of the intervention exercise. The intervention program was initiated with low-load activation of local motor control composing of local motor control exercises which were intended to activate the muscle regions isometrically with minimal loading positions. The motor control exercise intervention was based on the treatment method described in previous publications (15). The treatment approach has been designed into 3 progressive stages (**figure 2**). The motor control exercise treatment program has been given through three phases.

Figure 2. Activation of multifidus in prone lying position.

Table I. Intervention protocol with motor control exercises.

Phases	Exercises (Repetitions/Time Max up to 10 × 10 sec)
Phase 1 Low-load activation of local motor control (Mainly TrA, Deep Multifidus, Diaphragm and Pelvic floor	Crook lying abdominal hollowing exercise for transverse abdominis activation
	Activation of multifidus in pron
	Abdominal hollowing in sitting
	Abdominal hollowing in four points kneeling
	Activation of multifidus from sitting to lumbar neutral positio
Phase 2 Closed chain with low load and low velocity	Bridge in supine position
	Bridge in prone position
	Lateral bridge
Phase 3 Open chain with high load and velocity	Lower limb abduction
	Knee and hip extension in Crook lying
	Leg cycling
	Sitting knee raises on gym ball
	Abdominal slide
	Lying trunk curl with leg lift
	Basic superman

Group B: Global Postural Re-education (GPR) Intervention Group

The sample populations belonging to Group-B received the GPR program. The intervention group was taught with three postures that were found to be quite effective in stretching/lengthening the anterior as well as the posterior chains of the muscle group. For this study purpose to make the treatment uniformity, 2 or 3 postures were used (**table II**). The GPR intervention was based on the treatment method described in previous publications (16). These therapeutic postures held for 15-20 minutes each (**figure 3**). These postures are as follows:

- the lying posture with an extension of the legs and flexion of hip joints;
- the lying posture with flexion of hip joints
- the standing posture with flexion of the trunk

Statistical analysis

Standard Statistical Package for Social Sciences (SPSS) software was used for analyzing the data. This tests the reliability and validity of the scales by administering paired sample t-test. This is followed by testing of hypotheses by applying mean, median, mode, standard deviation, charts, and chi-square. The simple features of the study data are described by using descriptive statistics. They provide simple summaries about the measures and samples. Togeth-

Figure 3. The standing posture with flexion of the trunk.

Table II. Intervention protocol with Global Postural Reeducation.

Posture	Description (Postures held for 15-20 minutes each)
1.The lying posture with an extension of the legs and flexion of hip joints to release anterior muscle chain including diaphragm muscle	The patients were instructed to lie down in the supine position with upper limbs abducted to 30° and placing the forearms in the supine position. The hip region was flexed, abducted and rotated on the lateral aspects. The foot sole must be touching each other while performing the posture. Manual traction was applied along the neck region for aligning the dorsal and cervical portion of the spinal column. Sacral traction was also performed to straighten the lumbar part of the spinal column.
2.The lying posture with flexion of hip joints to release posterior muscle chain	The patients were instructed to lie down in supine position with adduction of the upper limbs followed by flexion of hip joint to stretch the posterior part of the muscle chain. Progression consisted of increasing hip flexion, knee ex ension and ankle dorsiflexion
3. The standing posture with flexion of the trunk to release posterior muscle chain	The sample patients were instructed to maintain a posture in an upright position followed by the patient to progressively bending towards the forward direction, as well as maintaining the occiput, sacral and thoracic spine portion to be aligned properly.

er with simple graphics analysis, they form the basis of virtually every quantitative data analysis. The level of significance was established at P-value < 0.05.

Sample size and calculation

The sample size was calculated using following formula:

$N = 4\ \sigma 2\ (Z_{\alpha} + Z_{\beta})\ 2/D2$

Where:

- N is the total sample size require;
- σ is the standard deviation of the outcome variable same for both the group;
- Z_{α} is the confidence level
- Z_{β} is the power;
- D is the effect size.

Level of significance taken was as per 0.05 value and power was 0.80. Effect size was calculated from mean and standard deviation of previous study. Values of standard deviation, mean was taken from previous study and effect size was calculated on the basis of previous study also (16, 17).

RESULTS

The study participants were subjected to MCE group and GPR group, each group comprising 100 participants in each group were evaluated after dropout of 23 participants from MCE group and 16 participants from GPR group.

The obtained results include the demographic profile of the respondents, descriptive statistics reflecting the characteristics of the sample and response rate of the respondents. The Effectiveness of this study is on a "Global Postural Re-education (GPR)" program and motor control exercises (MCE) for non-specific Low Back Pain

This tests the reliability and validity of the scales by administering paired sample t-test. This is followed by testing of hypotheses by applying mean, median, mode, standard deviation, charts, and chi-square. Standard Statistical Package for Social Sciences (SPSS) software was used for analyzing the data.

Both groups significantly reduced pain after intervention compared to the baseline evaluation. Baseline evaluation in MCE presented a pain level of 4.98 ± 1.26 points. At the end of intervention, the pain reduced to 4.25 ± 1.23 ($p < 0.001$) (**table III**). On the other hand, GPR showed baseline pain level of 4.98 ± 1.26 points and after intervention reducing to 1.72 ± 0.92 ($p < 0.001$) (**table III**). Finally, GPR demonstrated significantly lower pain level (1.72 ± 0.92) than MCE (5.00 ± 1.29) after the intervention protocol ($p < 0.001$) (**table III**).

The MOLBPDI (Modified Oswestry low Back Pain Disability Index) decreased markedly to 37.46 ± 7.41 to 32.66 ± 7.15 in MCE group after the intervention ($p < 0.001$) (**table III**) and GPR group maintained noticeably lower scores of 38.3 ± 8.75 to 20.3 ± 4.81 as compared to pre scores. Both groups improved their scores at the post intervention evaluation ($p < 0.001$) (**table III**), but GPR group scores decreases significantl . There was a statistically significant difference in post mean values of GPR-MOLBPDI and MCE-MOLBPDI, 20.30 ± 4.81 and 32.66 ± 7.15 respectively (**table III**).

Functional status were evaluated by using Fingertip to Floor test ($p < 0.001$) and improved flexibility in both groups but GPR showed a significant increase in functional status of 18.12 ± 4.67 to 9.22 ± 2.88 when compared pre and post mean values (**table III**) and MCE group showed less significant result from 18.93 ± 4.23 to 16.26 ± 3.99 (**table III**).

Table III. Comparison between the GPR and MCE group at pre and post intervention scores.

Outcome measures	Group	Baseline or Pre intervention Scores	Post intervention Scores	Post mean Values	P-value
NPRS for Pain	**MCE**	4.98 ± 1.26	4.25 ± 1.23	5.00 ± 1.29	< 0.001
	GPR	4.98 ± 1.26	1.72 ± 0.92	1.72 ± 0.92	< 0.001
MOLBPDI for Disability	**MCE**	37.46 ± 7.41	32.66 ± 7.15	32.66 ± 7.15	< 0.001
	GPR	38.3 ± 8.75	20.3 ± 4.81	20.30 ± 4.81	< 0.001
FFT for Functional status	**MCE**	18.93 ± 4.23	16.26 ± 3.99	16.26 ± 3.99	< 0.001
	GPR	18.12 ± 4.67	9.22 ± 2.88	9.22 ± 2.88	< 0.001

The GPR group showed a significant reduction in all outcome measures as compared to MCE group when compared pre scores to post scores.

DISCUSSION

The study result demonstrates that the conducts of care provider and the contents of exercise programs based on the home were both important and the contributor follows the programs. Health providers' home-based exercise and style program conditions emerged as powerful themes in our data. Our discovery supports the hypothesis that the GPR involvement is fruitful in non-specific low back pain with less disability levels when compared to MCE. Patients allocated to the GPR group showed significant improvement in functional disability and pain intensity as compared to the MCE group. The results are similar to those get in both male and female but the majority of respondents are male (19), who display the good results of the GPR as a compared program of analytical exercises in patients with ankylosing spondylitis, and those get in other researchers on LBP cited in the review (18). Therefore, it appears that Global Postural re-education is better in reducing pain and disability in subjects with non-specific LBP than segmental techniques. However, these results are varied from those by Cunha *et al.* (20), who did not find various outcomes comparing conventional static stretching and muscle chain stretching in chronic neck pain (20). The causes for these various outcomes may be related to both the areas affected by spinal pain and the fact that GPR might be more effective when compared to analytical stabilization or mobilization techniques, although it is not higher level to other stretching techniques (16).

When bearing in mind the clinical importance of our research, we can state that the GPR program produced a clinically meaningful improvement in comparison with MCE group. Both the groups were treated three times in week for five weeks and one hour per session. The mean fruitful of the MCE program were low relevant than those reported in some previous trials (21) but are in line with those obtained in some other recent studies (22).

Even than these results are slightly varied from Choopani *et al.*, who compared segmental stabilization exercises and general exercises and found that stabilization exercises were more effective in patients with spondylolisthesis ($p < 0.001$) (20). My study also shows effectiveness of stabilization exercise, but GPR technique was more fruitful.

However, the identification of subgroups is a tough process, since it cannot be identified yet be guided by a coherent theory of causation of back pain (24). Moreover, the disability levels of the patients cover in our research are less compared to previously published disability scores in "non-specific LBP" populations. Moreover, both therapies consisted of a one-to-one supervised exercise program actively requiring the patient: according to the literature, these kinds of management are fruitful to decrease disability and improve function in chronic LBP (25).

Apart from the strong clustering, the diagnosis could be adjusted only for patient factors (*e.g.*, because of the variance in socioeconomic factors between patient arms they adjusted for socio-occupational status). The outcome variance can be calculated, and some other factors also describe the part of outcome variance calculation. It is usually assumed that the more experienced physical therapists give the better outcomes in clinical (26). However, some current researchers assess the relationship between year of patient outcomes and the year of experienced physiotherapists, if the outcomes reported were not associated with improved patient outcomes in outpatient rehabilitation (27).

Moreover, the major strength of this study was presence of the simple randomization. This practical choice could have not led to some possible sources of bias: the two groups were having the same baseline, but slightly varied for socio-economical characteristics; this issue was considered in the multivariate analysis, taking this into account the possible different aggregation of patients within the different centres.

Another major restriction was the elevated number of dropouts in both the groups MCE as well as GPR. Furthermore, dropped-out patients varied on critical baseline behaviors from those who completed the study; on the other hand,

they were equally represented in the two groups (MCE and GPR). The high number of dropouts was mainly due to the resolution of patients to give up therapy in the absence of expected results and from GPR group was due to the inability to hold the posture for particular time. Dropouts from both groups had higher levels of disability and pain. This aspect was managed with the intent to treat approach, which confirmed the improvement obtained in the GPR group with respect to the MCE group at the per protocol analysis (28).

According to my views, GPR alone cannot be effective for non-specific LBP treatment, and it can be considered an important approach in the management of non-specific LBP patients at low disability levels. As per results of my study we cannot apply GPR intervention to subjects with high disability level of non-specific LBP. The GPR method is based on the global stretching of antigravity muscles and the stretching of muscles that are organized on muscles kinetic chain (29). When the length of the muscle fibre is chronically altered, the numbers of sarcomeres adjust to compensate the change, which affects the functional capability of muscle. One study shows that the generation of the tension in the skeletal muscle, measured by evaluation the length-tension relationship, is directly correlated with the degree of superimposed of actin and myosin filaments. During rest, less superimposition of actin and myosin fil - ments translating to greater capacity of the muscle of greater tension (30). This principle explains the result of my study as I applied global stretching techniques designed to improve length-tension relationship along with contraction of antagonist muscle, thereby improving postural symmetry and muscle capability because postural asymmetry may results in lower endurance of affected muscles and the increased risk of injury in the future when compared to people without postural asymmetry predicates effectiveness of postural correction (31).

Many physiotherapy methods are effective in management of non-specific LBP according to literature. Now a day's GPR method is not considering as treatment of choice for non-specific low back pain. This may be because of little evidence of effectiveness of GPR method. So, my study will be benefitted to professionals who are working for non-specific LBP and also for community suffering from this ailment.

It also needs higher level of studies. Some suggestions are the measurements of effectiveness of the clinical effects of the GPR on non-specific LBP subgroups, related to the phases of pain as acute, sub-acute and chronic pain and others are age of patients, *etc.*

Furthermore, the GPR effectiveness with other techniques such as manipulation, specific exercises or traction, *etc.*, can be compared.

Moreover, patients follow the home exercise program which could not be monitored. Indeed, follow the therapeutic program represents in a crucial aspect of chronic low back pain therapy (28) and appear to be related to professional characteristic and explanations and to the total number of exercises prescribed, as well as to individual and psychological characteristics (32).

Since the potential effect of physical and sports actions or cognitive-characteristic aspects was not review, the presence of a complex condition as a result of physical and psychosocial factors can be included (33). As an outcome, definitely explain the GPR alone does not helpful for the patient with low back pain, but the GPR can be considered as a significance approach for the management of a patient with low disability level and persistent LBP. Because dropouts from both GPR and MCE groups had increased level of disability and pain than the subjects who completed the trial, they cannot apply our outcomes to the subject with more disabling low back pain.

Many of the physical therapy methods could be helpful in low back pain; most of the therapist studied by serious clinical trials. The current research trend on this title allows to identify clinical prediction restrictions and some of the proposed classifications that can be applied to low back pain subgroups.

Low back pain patients sub grouping is related to techniques as particular exercises or traction, manipulation and stabilization. But the GPR therapy is not considered within that sub grouping. This is mainly due to a usual lack of knowledge and to the compact proof of fruitfulness of this method. Exercise programs based on home is known to interfere with daily routine and normal lifestyles (34). The statement of this study consistent with proof that present contributors have chronic neck or back pain reduction more to follow the prescribed home exercises when the home program requires a longer time for execution or includes exercises which are difficult to perform. To minimize the daily routine interruption caused by exercises it gives a solution for a continuation of home-based exercise (35). One solution would be restricting the number of exercises advice in each program. Similarly, there is evidence suggesting that more than eight exercises in a program play a negative influence on contributor follow the advised exercises (36).

The results proposed that a proper supervision during the exercise execution for the duration of a session may be a further chance to reduce patient's lack of confidence and panic of exercising at home. Health provider's style is fin - ings on the subject of how health provider's style is important for contributor following adherence to home-based exercise program confirm and expand previous findings (37). The contributor to this study recognized that a super-

vised instruction which includes proper feedback which is most important for their adherence. It is proof that exercises based only on written instructions are not often performed properly, and therefore lead to poorer outcomes than when compared with outcomes from exercises learned under the supervision of a care provider (34). Nevertheless, there is also proof that an attractive exercise mode mixed with written command improves adherence to exercises of patients presenting back pain (32).

Put in writing command during particular daily activities were normally used as reminders for our contributor. The contributor to our research often felt that these nudges were important. In the same way, the use of nudge has also been suggested by related studies, due to the fact that patients tend to forget exercising or have serious complexities in fitting the exercises into their daily routine (38)

Our study may represent the first step in this direction, but it should be followed by further, higher level studies. Accordingly, some suggestions for future research are the calculation of the clinical effects of the GPR on specific LBP subgroups, with respect to the age of patients, the phase of disorder (*e.g.*, acute, sub-acute or chronic pain), and the clinical characteristics. The GPR can be investigated with or without the novel lumbar support device on pain modulation and core muscle function among people with CNLBP (39). Moreover, the fruitfulness of GPR should be compared with other techniques, as manipulative treatment, cognitive characteristic treatment, *etc.*

Study limitations

However, there are some weaknesses in our study. The major restriction was the elevated number of dropouts in both the groups MCE as well as GPR.

The study satisfied the sample size, even than the study included short-term intervention such as three times a week for five-week treatment period onl .

Another limitation is lack of short- and mid-term follow-up, which would reveal a significant result (from baseline) in all outcome measures with respect to both the group.

The study should have included a control group, so future study should include control group for obtaining best results. Another limiting factor of my study is lack of sub grouping. Some suggestions are the measurements of effectiveness of the clinical effects of the GPR on non-specific LBP subgroups, related to the phases of pain as acute, sub-acute and chronic pain and others are age of patients, *etc.*

Furthermore, the GPR effectiveness with other techniques such as manipulation, specific exercises or traction, *etc.*, can be compared.

CONCLUSIONS

The evaluated test report of MCG and GPR were compared, all the post effect showed an improvement when compared to pre-results. Both the method Global Postural Re-Educational Program and Motor Control Exercise during the assessment showed less or more similar effectiveness. While comparing the evaluated report and effects from Motor Controlled Exercise and Global Postural Re-education program, effectiveness was found in GPR program than MCE, this is compared and evaluated during the difference obtained from pre-study to post-study results from MOLB-PDI, NPRS and FFT process.

FUNDINGS

None.

DATA AVAILABILITY

Data are available under reasonable request to the corresponding author.

CONTRIBUTIONS

AK: responsible for the whole work.

CONFLICT OF INTERESTS

The author declare that he has no conflict of interests.

REFERENCES

1. Walker BF. The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. J Spinal Disord 2000;13(3):205-17.
2. Koes BW, van Tulder MW, Thomas S. Diagnosis and treatment of low back pain. BMJ 2006;332(7555):1430-4.
3. Chou R, Qaseem A, Snow V, *et al*; Clinical Efficacy Assessment Subcommittee of the American College of Physicians; American College of Physicians; American Pain Society Low Back Pain Guidelines Panel. Diagnosis and treatment of low back pain: a joint clinical practice guideline from

the American College of Physicians and the American Pain Society. Ann Intern Med 2007;147(7):478-91.
4. Tekur P, Singphow C, Nagendra HR, Raghuram N. Effect of short-term intensive yoga program on pain, functional disability and spinal flexibility in chronic low back pain: a randomized control study. J Altern Complement Med 2008;14(6):637-44.
5. Haddadi Esfahani N, Dommerholt J, Sadat Rezaeian Z. Core Muscles Endurance in Sedentary Staffs with and without Nonspecific Chronic Low Back: A Cross-sectional Study. Muscles Ligaments Tendons J 2021;11(1):136-50.
6. Shahmahmoodi T, Izadi Laybidy S, Rahimi A, Bokaee F, Rezaeian ZS. Rehabilitation in Subjects with Chronic non-specific Low Back Pain with Sacroiliac Joint Origin: Protocol for a Systematic Review. Muscles Ligaments Tendons J 2020;10(4):734-9.
7. Izadi Laybidy S, Shahmahmoodi T, Rahimi A, Bokaee F, Pourmomeny AA, Sadat Rezaeian Z. Therapeutic Electrical Stimulation Currents in Chronic Non-specific Low Back Pain: Designing a Systematic Review. Muscles Ligaments Tendons J 2020;10(3):493-8.
8. Dimer da Luz R, da Silva Santos M, Steffen Evaldt A, da Silva Matos L, Boff Daitx R, Dohnert MB. Neuromuscular electrical stimulation associated with core stability exercises in nonspecific postural low back pain: a randomized clinical trial. Muscles Ligaments Tendons J 2019;9(3):446-56.
9. O'Sullivan P, Twomey L, Allison G, Sinclair J, Miller K. Altered patterns of abdominal muscle activation in patients with chronic low back pain. Aust J Physiother 1997;43(2):91-8.
10. Hodges PW, Richardson CA. Delayed postural contraction of transversus abdominis in low back pain associated with movement of the lower limb. J Spinal Disord 1998;11(1):46-56.
11. Hodges PW, Richardson CA. Altered trunk muscle recruitment in people with low back pain with upper limb movement at different speeds. Arch Phys Med Rehabil 1999;80(9):1005-12.
12. Holm S, Indahl A, Solomonow M. Sensorimotor control of the spine. J Electromyogr Kinesiol 2002;12(3):219-34.
13. Solomonow M, Zhou B, Baratta RV, Zhu M, Lu Y. Neuromuscular disorders associated with static lumbar flexion: a feline model. J Electromyogr Kinesiol 2002;12(2):81-90.
14. Solomonow M, Baratta RV, Zhou BH, Burger E, Zieske A, Gedalia A. Muscular dysfunction elicited by creep of lumbar viscoelastic tissue. J Electromyogr Kinesiol 2003;13(4):381-96.
15. Costa LO, Maher CG, Latimer J, *et al*. Motor control exercise for chronic low back pain: a randomized placebo-controlled trial. Phys Ther 2009;89(12):1275-86.
16. Bonetti F, Curti S, Mattioli S, *et al*. Effectiveness of a 'Global Postural Reeducation' program for persistent low back pain: a non-randomized controlled trial. BMC Musculoskelet Disord 2010;11:285.
17. Pratap P. Sample size in clinical research, the number we need. International J Med Sci Pub Health 2012;1(1):05-09.
18. Dohnert MB, Schwanck Borges C, Steffen Evaldt A, *et al*. Lumbopelvic Stabilization Exercises and McKenzie Method in Low Back Pain Due to Disc Protrusion: A Blind Randomized Clinical Trial. Muscles Ligaments Tendons J 2020;10(4):740-751.
19. Fernández-de-Las-Peñas C, Alonso-Blanco C, Morales-Cabezas M, Miangolarra-Page JC. Two exercise interventions for the management of patients with ankylosing spondylitis: a randomized controlled trial. Am J Phys Med Rehabil 2005;84(6):407-19.
20. Cunha AC, Burke TN, França FJ, Marques AP. Effect of global posture reeducation and of static stretching on pain, range of motion, and quality of life in women with chronic neck pain: a randomized clinical trial. Clinics (Sao Paulo) 2008;63(6):763-70.
21. Yang EJ, Park WB, Shin HI, Lim JY. The effect of back school integrated with core strengthening in patients with chronic low-back pain. Am J Phys Med Rehabil 2010 Sep;89(9):744-54.
22. Koumantakis GA, Watson PJ, Oldham JA. Trunk muscle stabilization training plus general exercise versus general exercise only: randomized controlled trial of patients with recurrent low back pain. Phys Ther 2005;85(3):209-25.
23. Choopani R, Ghaderi F, Salahzadeh Z, *et al*. The effect of segmental stabilization exercises on pain,disability and static postural stability in patients with spondylolisthesis: a double blinded pilot randomized controlled trial. Muscles Ligaments Tendons J .2019;9(4):615-26.
24. Ferreira ML, Ferreira PH, Hodges PW. Changes in postural activity of the trunk muscles following spinal manipulative therapy. Man Ther 2007;12(3):240-8.
25. Wells C, Kolt GS, Marshall P, Hill B, Bialocerkowski A. The effectiveness of Pilates exercise in people with chronic low back pain: a systematic review. PLoS One 2014;9(7):e100402.
26. Jensen GM, Shepard KF, Hack LM. The novice versus the experienced clinician: insights into the work of the physical therapist. Phys Ther 1990;70(5):314-23.
27. Resnik L, Liu D, Mor V, Hart DL. Predictors of physical therapy clinic performance in the treatment of patients with low back pain syndromes. Phys Ther 2008;88(9):989-1004.
28. Liddle SD, Gracey JH, Baxter GD. Advice for the management of low back pain: a systematic review of randomised controlled trials. Man Ther 2007;12(4):310-27.
29. Teodori RM, Negri JR, Cruz MC, Marques AP. Global Postural Re-education: a literature review. Rev Bras Fisioter. 2011 May-Jun;15(3):185-9. English, Portuguese.
30. Salahzadeh Z, Rezaei M, Adigozali H, Sarbakhsh P, Hemati A, Khalilian-Ekrami N. The Evaluation of Trunk Muscle Endurance in People with And Without forward Head Posture: a Cross-Sectional Study. Muscles Ligaments Tendons J 2020;10(4):752-8.
31. Moreno MA, Catai AM, Teodori RM, Borges BL, Cesar Mde C, Silva Ed. Efeito de um programa de alongamento muscular pelo método de Reeducação Postural Global sobre a força muscular respiratória e a mobilidade toracoabdominal de homens jovens sedentários [Effect of a muscle stretching program using the Global Postural Reeducation method on respiratory muscle strength and

thoracoabdominal mobility of sedentary young males]. J Bras Pneumol 2007;33(6):679-86.
32. Escolar-Reina P, Medina-Mirapeix F, Gascón-Cánovas JJ, *et al*. How do care-provider and home exercise program characteristics affect patient adherence in chronic neck and back pain: a qualitative study. BMC Health Serv Res. 2010 Mar 10;10:60.
33. Daykin AR, Richardson B. Physiotherapists' pain beliefs and their influence on the management of patients with chronic low back pain. Spine 2004;29(7):783-95.
34. Friedrich M, Gittler G, Halberstadt Y, Cermak T, Heiller I. Combined exercise and motivation program: effect on the compliance and level of disability of patients with chronic low back pain: a randomized controlled trial. Arch Phys Med Rehabil 1998;79(5):475-87.
35. Dean SG, Smith JA, Payne S, Weinman J. Managing time: an interpretative phenomenological analysis of patients' and physiotherapists' perceptions of adherence to therapeutic exercise for low back pain. Disabil Rehabil 2005;27(11):625-36.
36. Henry KD, Rosemond C, Eckert LB. Effect of number of home exercises on compliance and performance in adults over 65 years of age. Phys Ther 1999;79(3):270-7.
37. Slade SC, Molloy E, Keating JL. People with non-specific chronic low back pain who have participated in exercise programs have preferences about exercise: a qualitative study. Aust J Physiother 2009;55(2):115-21.
38. Bartlett EE. Behavioral diagnosis: a practical approach to patient education. Patient Couns Health Educ 1982;4(1):29-35.
39. Dissanguan D, Sitilertpisan P, Joseph LH, Paungmali A. Immediate Effects of a Novel Lumbar Support Device on Pain Modulation and Core Muscle Function in Patients with Chronic Non-Specific Low Back Pain: a Randomized Controlled Trial. Muscles Ligaments Tendons J 2021;11(3):439-48.