The Effectiveness of Proprioceptive Neuromuscular Facilitation and Mckenzie Method in Quality of Life on Non-Specific Low Back Pain

Lucky Anggiat, BPT,[1,2] Wan Hazmy Che Hon, MD, MSOrtho,[3,5] and Siti Nur Baait, BPT, MPT[4]

ABSTRACT

Background of study: Prolonged sitting has been identified as one of the factors leading to non-specific low back pain among students and staffs in university. Non-specific low back pain will also affect the quality of life of the patient or university population. The impact of low back pain on quality of life can be due to the severity of pain. Exercise therapy is one of the mainstays in the management of non-specific low back pain. One of the most common exercise therapy for non-specific low back pain is the McKenzie method, whereas the Proprioceptive Neuromuscular Facilitation (PNF) exercise is seldom been used to treat non-specific low back pain cases. There were not many studies being done to compare these two techniques on its effectiveness for PNF and McKenzie method on non-specific low back pain.

Objective: The purpose of the study is to find the effectiveness of PNF and McKenzie method on non-specific low back pain in quality of life.

Design and Participants: In this study, a randomised clinical trial method was involving 36 subjects (students and staffs) from the university population was randomly chosen to participate based on the selection criteria set by the study protocols.

Intervention: The subjects were randomly assigned to three treatment groups: PNF group, McKenzie group and control group (hot pack and educational home exercise sheet) which underwent 12 treatment sessions distributed over three times in a week for four weeks duration.

Measurement: Subjects were measured health-related quality of life by SF-12. Measurement was performed at three points: pre-test, mid-test and post-test. Repeated measures ANOVA were used to analyse the study results. The within-between groups analysis performed to analyse the difference between the effectiveness of three treatments based on the measurement time.

Results: This study showed each treatment has significant improvement in health-related quality of life ($p<0.05$) after 4 weeks. However, there is no significant difference between PNF and McKenzie method ($p>0.05$) after 4 weeks.

Conclusion: The study findings showed that the PNF exercise and McKenzie method has equal improvement in health-realted quality of life on non-specific low back pain. **KPJ Medical Journal 2018; 7:14–25**

Keywords: PNF, McKenzie, non-specific low back pain, health-related quality of life

INTRODUCTION

Prolonged sitting is one of the factors causing musculoskeletal pain specifically the office staffs who suffered from having low back pain which commonly reported. A study done from one of the University in Columbia, found that 45% of the university population were having severe chronic pain specifically in the lower back region which led several limitations during academic activities at the range of about 29.8%.[1] A study done by Nordin Devinder and Kanglun, on the health sciences undergraduate students have demonstrated approximately 80% of younger population experience LBP due to their physical fitness and sitting for too long.[2]

From studies reported, both office workers and students are at risk to develop low back pain, which has been proven in some researches with having negative impact to their activities in the university. A study by Casas et al., found that the prevalence of limitation for academic activities was almost 30% and which affected both office workers and students, on their daily life activities and causing potential effect on both office workers and students quality of life.[1] The limitation in

[1] School of Health Sciences, Master of Physiotherapy Program, KPJ Healthcare University College, Nilai, Negeri Sembilan, Malaysia

[2] Academy of Physiotherapy, Christian University of Indonesia, Jakarta, Indonesia

[3] School of Medicine, KPJ Healthcare University College, Nilai, Negeri Sembilan, Malaysia

[4] School of Health Sciences, Physiotherapy Department, KPJ Healthcare University College, Nilai, Negeri Sembilan, Malaysia

[5] KPJ Seremban Specialist Hospital, Seremban, Malaysia

Correspondence: Prof Dr Wan Hazmy Che Hon
Consultant Orthopaedic Surgeon
KPJ Seremban Specialist Hospital
Jalan Toman 1, Kemayan Square, 70200 Seremban
Negeri Sembilan Darul Khusus, Malaysia
Email: whazmy@hotmail.com

academic activities due to pain was 29.8% and other researchers concluded, moderate disability due to LBP among physiotherapy students in Mumbai.[3] The similar potential risk happened to office workers suffering from LBP. An employee with LBP usually takes a day off from their work for medical check-up, which consequently, drop the company's productivity if it has a significant number of employees absent from work due to having LBP.[4] The low back pain also affected patients' quality of life. A study reported that higher pain score can be associated with lower HRQoL, which means that the quality of life would be worst due to increasing pain score.[5]

Exercise therapy was found to be the best choice to reduce low back pain and increase body functions in adult people who suffered low back pain.[6] The therapeutic exercise for LBP uncommonly performed by physiotherapist is Proprioceptive Neuromuscular Facilitation (PNF), however; this treatment is commonly used for neurological conditions.[7] PNF has been recommended for sensory-motor control training, as well as for stimulating lumbar muscle proprioception.[8]

A commonly used exercise therapy for LBP was developed by Brian McKenzie, which was recognised as McKenzie method.[9] A systematic review study has shown that McKenzie therapy is more effective than the comparison treatment at short-term follow up for spinal pain. McKenzie method can be a familiar treatment and is one of the common choices used by most physiotherapists for treating low back pain.[10]

There were several studies performed the specific exercises to treat LBP, such as McKenzie method, PNF, ball exercise, yoga, spinal stabilization exercise, Mat based Pilates and ordinary exercise like aerobic exercise which is effective with good result for LBP.[10,11,12,13,14,15,16] However, these studies did not do any comparison between PNF exercise and McKenzie method to verify the effectiveness of each treatment.

METHODOLOGY

This is an experimental study using randomized clinical trial. This study was comparing the effect and value of intervention in between three groups at their pre-test, mid-test and post-test design in which subjects are equally differentiated on the treatment given and control group. The three groups of subjects who have been managed with PNF exercise, McKenzie method and control group respectively were compared. This research was conducted in KPJ Healthcare University College (KPJUC), Nilai, Malaysia. The subjects were KPJUC students and staff who met the selection criteria prior to sample screening. They were undergoing a specified treatment for the non-specific low back pain in KPJUC Rehabilitation Centre. The timing for the implementation of data collection and testing of the research subjects was from August 2017 – December 2017.

Sample Size

The determination of the sample size was done using G*power 3. Three group, using F test, the effect size f is 0.25. Based on the data, the calculated total sample size is thirty and as additional subject is 20% from total sample size, which is six, then total sample size is thirty-six with twelve subjects for each group.[17]

Inclusion Criteria

Subject with non-specific chronic low back pain and with age > 18 to 45 years old.[18,19] Study or work in prolonged sitting position ≥ 3 hours a day.[20]

Exclusion Criteria

Subjects with any history of pathological conditions or diagnosed with disk herniation, spinal stenosis, spondylolysthesis, spondylitis, radiculopathy, vertebral fracture and surgery to lumbar spine.[1] Subject with reported pregnancy or with other medical illnesses such as tumor, kidney disease, and visceral disease.[21,22]

Measuring Tools

As an examination of health-related quality of life, subjects were assessed using the SF – 12 health survey. This is a multipurpose, generic HRQoL instrument. Two summary scores calculated from this measure were used the physical component summary (PCS), an index of overall physical functioning, and the mental component summary (MCS) scores, which is an index of mental and emotional health (See Appendix). SF- 12 have 12 items that measure the health concepts of physical functioning, role limitations due to physical health problems, body pain, general health, vitality, social function, role limitations due to emotional problems, and mental health.[23]

The domains are summarised in a physical and a mental component summary. Physical and Mental Health Composite Summary (PCS and MCS) are using the scores of for each section. PCS the highest score is 20 and 27 for MCS highest score. The lowest score indicates the lowest level of health measured and the highest score for each section indicates the highest level of health.[24]

Research Procedures

The preparation of the subjects includes several stages stated as follow; the first stage is to provide a questionnaire to KPJUC students and staffs. The questionnaire provided to determine the subjects who were experienced low back pain. After the questionnaire completed, selection of subjects performed according to the inclusion criteria. Then the subject was given an explanation by verbal and written about the purpose and

benefits of the study prior to signature of inform consent to certify their willingness to be the subject of research.

Subsequently, the researcher and physiotherapist assessed the subject based on the measurements. Then the subject divided into three treatment groups by simple randomization using lottery method. All subjects picked a number with number one entered in group one (group I) and the subject with number two entered into group two (group II) and number three to group three (group III) until all the research subjects included to the three intervention group.

The Physiotherapists performed the assessment outcome measurements. All subjects were assessed with health-related quality of life questionnaire using SF-12. The assessment point was performed at three points; pre-test as the baseline measurement, mid-test which is two weeks after treatment and post-test as the last measurement after four weeks treatment. This study conducted in a private academic institute and the ethical approval has been obtained from School of Health Sciences, KPJ Healthcare University College, in Nilai, Negeri Sembilan, Malaysia.

Intervention Procedures

Subjects in the group I received the PNF exercise intervention (See Appendix). The PNF technique performed on the trunk movement. The patient is in sitting position. First, physiotherapist conducted Rhythmic Stabilisation Training (RST). The RST exercise consisted of alternating (trunk flexion-extension) isometric contractions against resistance for 10 seconds, with no motion intended. Subjects performed three sets of 10 repetitions at maximal resistance provided by the same physiotherapist. The resting intervals of 30 seconds and 60 seconds provided after the completion of 10 repetitions for each pattern and between sets, respectively. Secondly, physiotherapist conducted combination of isotonic technique with flexion or extension for lumbar, depending on the patient condition. The combination isotonic technique consists of alternating concentric and eccentric contractions of agonists without relaxation. The resisted active concentric contraction for 5 seconds, resisted eccentric contraction for 5 seconds, and resisted maintained during contraction for 5 seconds (trunk flexion-extension). The combination of isotonic performed three set of 10 repetitions with resting intervals of 30 second and 60 second were provided after completion of 10 repetitions for each pattern and between sets, respectively. Then, all PNF exercise will be held for 30-45 minutes.[12,25,26,27]

The subjects in the group II received the McKenzie method treatment. The physiotherapist guided the subject to conduct four extension exercises and three flexion exercises. The extension exercise started with; first, lying face down for one until two minutes. Second, lying face down with extension, the subject asked to start with lying face down position and followed with the extension of the trunk on the elbow and hold on for five seconds and back to first position as a relaxation. Third, extension on lying, subject instructed to start in lying face down position, and then followed with the extension of the trunk with elbow extension (push-up position) for ten seconds, then the subject asked to relaxation with back to first position. Forth, extension on standing, subject instructed to standing position and then asked to do the extension of the trunk and hold for five seconds with hands of the back and the fingers pointing backwards, then followed with relaxation with back to standing position. All extension exercise repeated for ten repetitions for two sets.

The flexion exercise started with; first, flexion on lying, subjects asked on lying position then flexes the trunk with both knees to the chest and hold with both hands. Subjects instructed to hold that position for five second and relaxation to the first lying position. Second, flexion on sitting, the subject asked to sit on the edge of a chair, and then instructed to bend the trunk forward and grasp the ankle or touch the floor with both hands. This position maintained for five seconds and followed with relaxation to the first position. Third, flexion on standing, the subject asked to standing position, then instructed to bend forward or flexion the trunk with fingers down to the legs as far as subject comfortably reach. Subject asked to hold the last position for five seconds and back to standing position as a relaxation. Then, all flexion exercise also repeated for ten repetitions for two sets. There are three minutes for resting intervals in every set. The McKenzie treatment lasted for 20-40 minutes.[9,28]

Subjects in the group III was treated with hot pack for 15 minutes as a basic treatment for non-specific low back pain and physiotherapist gave home exercise guided by educational exercise sheet (See Appendix 1) and teach the subjects how to use it.[29] A narrative review by Bardin, King and Maher, revealed that hot pack consider as a first line care for non-specific low back pain along with self-management with home exercise.[30] The exercise based on the educational exercise sheet lasted for 7-10 minutes that can be done at the home or the office (Appendix 2).[31] The subjects in control group treatment controlled three times a week to get the treatment.

DATA ANALYSIS

All data analyses were performed with the Statistical Package for the Social Science (SPSS) statistic software version 22. Repeated measures ANOVA analysis used to determine the result of differences before and after treatment in every group. Repeated measure ANOVA within-between group analyses were applied to determine the effect between three treatment groups based on time measurement. Bonferroni adjustment were applied for multiple comparison.

RESULTS

A total of 36 subject of non-specific low back pain who were included participate in this study was divided into three groups, those are PNF exercise, McKenzie method and Control group, using simple randomization sampling method with lottery method. The socio-demographic details such as age, gender and occupation are tabulated in Table 1.

Table 1 — Socio-demographic distribution of the subjects (N=36)

Parameter	Treatment Group, N (%)		
	PNF	McKenzie	Control
Age (Years)			
18 – 25	7 (58.3)	9 (75)	11 (91.7)
26 – 33	2 (16.7)	2 (16.5)	1 (8.3)
34 - 41	3 (25)	1 (8.3)	0 (0)
Gender			
Male	5 (41.7)	4 (33.3)	4 (33.3)
Female	7 (58.3)	8 (66.7)	8 (66.7)
Occupation			
Student	7 (58.3)	7 (58.3)	8 (66.7)
Staff	5 (41.7)	5 (41.7)	4 (33.3)
Years of Study/Working			
1-3 years	8 (66.7)	8 (66.7)	11 (91.7)
4-6 years	2 (16.7)	3 (25)	1 (8.3)
7-9 years	1 (8.3)	1 (8.3)	0 (0)
≥ 10 years	1 (8.3)	0 (0)	0(0)

The following described the findings of the effectiveness of PNF exercise and McKenzie method and control group on PCS in non-specific low back pain using repeated measure ANOVA within groups (based on time). Table 2 describe the within group result of PNF exercise, McKenzie and Control group in Physical Component Summary (PCS) in terms of Mean Difference (MD) and Confidence Interval (CI). Mauchly's test of Sphericity indicated that the assumption of sphericity had not been violated, $\chi^2(2) = 4.91$, p=0.086. Bonferroni pairwise comparison test was proceeded which allowed us to discover which specific means differed. The result showed that PNF exercise and Control group have significant result in 0 week to 2 week as p<0.05, while in McKenzie group was not significant. In 0 Week to 4 week, each group have significant difference as $p < 0.05$ with the most significant was PNF exercise as p=0.001. In 2 week to 4 week each group have significant difference as p<0.05 with the most significant was PNF exercise as p=0.006.

The following described the findings of the effectiveness of PNF exercise and McKenzie method and control group on MCS in non-specific low back pain using repeated measure ANOVA within groups (based on time).

Table 3 describe the within group result of PNF exercise, McKenzie and Control group in Mental Component Summary (MCS) in terms of Mean Difference (MD) and Confidence Interval (CI). Mauchly's test of Sphericity indicated that the assumption of sphericity had been violated, $\chi^2(2) = 6.03$, p=0.049, and therefore, a Greenhouse-geisser correction was used. There was a significant effect of time on

Table 2 — Comparison of physical component summary for each treatment group based on time (N=36)

Comparison	PNF		McKenzie		Control Group	
PCS	MD (95% CI)	*p*-value	MD (95% CI)	*p*-value	MD (95% CI)	*p*-value
0 week – 2 week	-1.41 (-2.82, -0.008)	0.049*	-1.00 (-2.66, 0.66)	0.355	-1.08 (-2.09, -0.07)	0.035*
0 week – 4 week	-3.25 (-5.05, -1.44)	0.001*	-2.58(-4.19, -0.97)	0.003*	-2.16 (-3.45, -0.87)	0.002*
2 week - 4 week	-1.83 (-3.12, -0.54)	0.006*	-1.58 (-2.85, -0.31)	0.015*	-1.08 (-1.89, -0.27)	0.009*

Repeated measure ANOVA within group analyses were applied followed by multiple comparison; MD = Mean Difference, CI = Confidence Interval. Bonferroni correction applied by correction level of significance. *Significant value at p<0.05.

Table 3 — Comparison of mental component summary for each treatment group based on time (N=36)

Comparison	PNF		McKenzie		Control Group	
MCS	MD (95% CI)	*p*-value	MD (95% CI)	*p*-value	MD (95% CI)	*p*-value
0 week – 2 week	-1.50 (-2.82, -0.17)	0.025*	-1.50 (-2.95, 0.04)	0.042*	-1.91 (-3.59, -0.23)	0.025*
0 week – 4 week	-3.16 (-4.75, -1.58)	0.001*	-4.50 (-6.99, -2.00)	0.001*	-3.66 (-5.37, -1.94)	0.001*
2 week - 4 week	-1.66 (-3.54, -0.21)	0.089*	-3.00 (-5.75, -0.24)	0.032*	-1.75 (-3.26, -0.23)	0.023*

Repeated measure ANOVA within group analyses were applied followed by multiple comparison; MD = Mean Difference, CI = Confidence Interval. Bonferroni correction applied by correction level of significance. *Significant value at p<0.05

weight F=49.07, p=0.001. Bonferroni pairwise comparison test was proceeded which allowed us to discover which specific means differed. The result showed that there was significant mean difference in each measurement time comparison for each group. In 0 Week to 2 week after treatment, each group had significant within group as p>0.05 with PNF exercise group and Control group were the most significant (p=0.025). In 0 week to 4 week, each group have significant difference as p<0.05 with same significant p-value. In 2 week to 4 week PNF, there was no significant difference in PNF group as p=0.089. However, McKenzie group had significant result as p=0.032 and Control group was the most significant as p=0.023.

The result of physical component summary (PCS) in between group analysis showed there was no significant difference of PCS between the groups (F= 0.243, p=0.785). Subsequently, the between group analysis in mental component also showed there was no significant difference of MCS between the groups (F= 1.69, p=0.200). Multiple comparisons were not proceeded as the overall F-test was not significant.

For time-treatment interaction result in repeated measure ANOVA within-between group analysis, founded that there was no significant mean difference of PCS (p=0.659) and MCS (p=0.657) based on time. It is indicated that the mean of PCS and MCS for each treatment were similar based on time. Multiple comparisons were not conducted as the global test was not significant. Assumption of normality, homogeneity of variances and compound symmetry were checked and were fulfilled.

DISCUSSION

The results for this study showed significant effect on health-related quality of life in each treatment among non-specific low back pain subjects. The subjects were assessed with Short-Form 12 (SF-12), which was divided into two score summaries. The physical component summary (PCS) and mental component summary (MCS) was measured, and all treatments showed good result in increasing the score of PCS and MCS after 4 weeks of treatment.

In order comparing the between groups, it was found that the result showed no significant difference in increasing the PCS and MCS also same goes to the time-treatment interaction that revealed no significant difference between three treatment group based on the time. Although the result between-group analyses were not significant in both components, the three treatments were equally improved on the PCS and MCS score in SF-12.

Following this result, there were similarities between the results concluded in the present study and with those described by Jadeja et al, in which they established that the PNF exercise has no significant difference to improve the PCS and MCS scoring using SF-36 health survey tools which have had the same summary with SF-12.[25] In their study, they only compared the PNF and conventional back exercise without another control group. In the within group analysis, the PNF showed significant result both in PCS and MCS scoring, whereas, the conventional back exercise was not significant. However, the comparison between group analyses showed, there were no significant difference between PNF and conventional back exercise. They also suggested having more than 4 weeks assessment to get better improvement in quality of life assessment.

Another study by Areeudomwong et al, showed certain disagreement with the present study.[32] They found that PNF showed significant improvement of PCS score both in within group and between groups, which compared with educational booklet only. However, the MCS score showed no significant in within and between groups result and the comparison only PNF with control group without another exercise therapy group. They also carried out the assessment for 12 weeks, follow-up with the same result after 4 weeks treatment. Although, the result of the previous study was contradicted, however, it can be said consistent with MCS result between PNF and control group in the present study.

In the latest study by Mazloum et al, the researchers strongly emphasized on the comparison between Pilates and McKenzie, which was found that both exercises were equally significant in improving the quality of life among low back pain subjects.[33] The study was comparing Pilates, McKenzie, and the control group, which was similar with the present study that compared the two active exercises and a control group. This study underwent for 6 weeks interventions and follow-up was made after 4 weeks. However, the quality of life score was measured by World Health Organization Quality of Life questionnaires, which differed with SF-12 that was used in the present study. Furthermore, the previous study can be implied based on the consistency with the present study.

In addition, the range of the improvement before and after treatment in PCS and MCS in this present study were not large, the difference of the improvement might be, statistically, not clearly defined. The previous studies also stated that the quality of life can be improved in long-term assessment while, this study was only measure in immediate effect after 2nd week and 4th week treatment.[25,33] A study by Jadeja et al. also stated that the health-related quality of life of the patients with non-specific low back pain depending on the functional status and physiological factors which will be more than simple physical impairment and suggested to add with behavioural programs to get better results to improve the quality of life[25]. However, in this present study, each group have shown better improvement in the quality of life, thus it can be concluded as one of the expected outcomes from this present study. Hence, those three treatments contribute to improving the quality of life which is related to students' academic activity such as

attending to the class and productivity of the office worker.[1,3,4]

CONCLUSION

In conclusion, it has been proven that the non-specific low back pain has affected both the students and the staffs in the university. The same habit of students and staffs were due to prolonged sitting more than 1 hour were the main caused even though the number of years working or studying in the university were only 1 year. Subsequently, in this study, the three treatments have statistically significant improvement for patient health-related quality of life in each group analysis. However, there were an equal improvement between PNF exercise and McKenzie methods to improve health-related quality of life in both physical component summary and mental component summary on non-specific low back pain.

RECOMMENDATION

For physiotherapist, we can give some suggestions to the clinical settings to choose combination of the treatment for non-specific low back pain with PNF exercise as the therapeutic touch treatment then teach the patient with proper McKenzie method as a home exercise program. Moreover, as prevention and self-management for the patient who have habits with prolonged sitting, physiotherapist can educate the patients to do exercise based on educational exercise sheet besides their regular treatment with physiotherapist.

ACKNOWLEDGEMENT

We are very thankful to all participants who participated in this research.

REFERENCES

1. Casas, A.S., Patino, M.S., Camargo, D.M. Association between the sitting posture and back pain in college student. Revista de la Universidad Industrial de Santander. Salud 2016; 48(4); 446-454.
2. Nordin, N. A., Devinder, A. S., & Kanglun, L. Low Back Pain and Associated Risk Factors among Health Science Undergraduates. Sains Malaysiana 2014; 43(3); 423–428. Retrieved from http://www.ukm.my/jsm/pdf_files/SM-PDF-43-3-2014/12 Nor Azlin Mohd Nordin.pdf
3. Patil, V.S., Master, M.F., Naik, R.V. A cross-sectional observational study on the prevalence of mechanical low back pain in physiotherapy students. National Journal of Intergrated Research Medicine 2016; 7(6); 9-12.
4. Ramdan, N, S, A., Hasyim A, Y, B., Kamat, S, R., Mokhtar, M, N, A., Asmai, S, A. On Lower-back pain and its consequence to productivity, Journal of Industrial and Intelligent Information 2014; 2, No. 2.
5. Resnik, L., and Dobrzykowski,E. Guide to outcome measurement for Patient with Low Back Pain syndromes, Journal of Orthopedic and Sport Physical Therapy 2003; 33; 307-318.
6. Scharrer M, Ebenbichler G, Peiber K, Crevenna, Gruther W, Zorn C, Grimm-Steiger, Herceg M, Keilani M, Ammer K. A systematic review on the effectiveness of medical training therapy for subacute and chronic low back pain. European Journal Phyhsical Rehabilitation Medicine 2012; 48; 361-70.
7. Westwater-Wood, S., Adam N., Kerry, R. The use of proprioceptive neuromuscular facilitation in physiotherapy practice. Physical Therapy Reviews 2010; 15 (1). DOI 10.1179/174328810X12647087218677.
8. Lee YJ.The effects of the PNF Techniques on lumbar stability and the functional activity in chronic low back pain patients. Department of Physical Therapy Graduate School of Dongshin University 2009; pp 1-60.
9. McKenzie, R. Treat your own back. Ninth Edition. New Zealand. Spinal Publications New Zealand Ltd, 2011.
10. Clare H, Adams R and Maher CG. A systematic review of efficacy of McKenzie therapy for spinal pain. Australian Journal of Physiotherapy 2004; 50; 209-216.
11. Garcia, A.N., Gondo, F.L.B., Costa, R.A., Cyrillo, F.N., Costa, L.O.P. Effects of two physical therapy interventions in patients with chronic non-specific low back pain : feasibility of a randomized controlled trial. Revista Brasileira Fisioterapia, Sao Carlos 2011; 15, n.5; p.420-7.
12. Kumar A., Zutshi K,. Narang N. Efficiacy of Trunk Propioceptive Neuromuscular Facilitation Training on Chronic Low Back Pain. International Journal of Sports Science and Engineering Vol. 05, 2011; No. 03; 174-180.
13. Park, S. E., Wang, J.S. Effect of joint mobilization KEOMT and PNF on a patient with CLBP and a lumbar transitional vertebra : a case study, Journal of Physical Therapy Sciences 2015; 27; 1629-1632.
14. Lee, C.-W., Hwangbo, K., & Lee, I.-S. The effects of combination patterns of proprioceptive neuromuscular facilitation and ball exercise on pain and muscle activity of chronic low back pain patients. Journal of Physical Therapy Science 2014; 26(1); 93–6. https://doi.org/10.1589/jpts.26.93.
15. Johnson, S., Rodriguez, J.L., Rosario, E. Measuring the efficacy of rehabilitation for low back pain. The Journal of southern California Clinicians. 2011; 5. No.1.
16. Young, K. J., Je, C. W., & Hwa, S. T. Effect of proprioceptive neuromuscular facilitation integration pattern and swiss ball training on pain and balance in elderly patients with chronic back pain. Journal of Physical Therapy Science 2015; 27(10); 3237–40. https://doi.org/10.1589/jpts.27.3237.
17. Hasanpour-Dehkordi, A., Dehghani, A., Solati, K.. A comparison of the effects of Pilates and McKenzie training on pain and general health in men with chronic low back pain: A randomized trial. Indian Journal of Palliative Care 2017; 23; 36-40. DOI: 10.4103/0973-1075.197945.
18. Damanhuri, Z., Zulkifli A., Lau, A.C. T., Zainuddin, H. Low back pain among office workers in a public university in Malaysia. International journal of Public Health and Clinical Sciences 2014; 1; No. 1.
19. Casser HR, Seddigh S, Rauschmann M. Acute lumbar back pain—investigation, differential diagnosis and treatment. Deutsches Ärzteblatt International 2016; 113: 223 34. DOI: 10.3238/arztebl.0223.
20. Issa LF,. Seleem NA,. Bakheit AM,. Baky AA,. Alotaibi AF. Low back pain among undergraduate student at Taif University-Saudi Arabia. International Journal of Public Health and Epidemiology 2016; 5 (6); 275-284.
21. Maher, C., Underwood, M., Butchbindee, R. Non-specific low back pain. Seminar, Lancet 2017; 389; 736-47.

22. Sihawong R., Sitthipornvorakul, E., Paksaichol, A., Janwantanakul P. Predictors for chronic neck and low back pain in office workers : a 1-year prospective cohort study. Journal of Occupational Health 2016; 58; 6-24.
23. Ware J. E., Kosinski, M., Keller, S.D. SF-12: How to score the SF-12 physical and mental health summary scales, Second Edition.The Health Institute, New England Medical Center. Boston, MA, 1996.
24. Ueberall, M., Eberhardt, A., Mueler-Schwefe. Quality of life under oxycodone/naloxone, oxycodone, or morphine treatment for chronic low back pain in routine clinical practice. International Journal of general medicine 2016; 9; 39-51.
25. Jadeja, T., Vyas, N., Sheth, M. To Study the effect of proprioceptive neuromuscular facilitation on back muscle strength, pain, and quality of life in subjects with chronic low back pain-an experimental study. International Journal of Physiotherapy 2015; 2(5); 778-785.
26. Kofotolis, N., Kellis, E. Effect of two 4-week proprioceptive neuromuscular facilitation programs on muscle endurance, flexibility, and functional outcomes performance in women with chronic low back pain. Physical Therapy 2006; 86 (7); 1001-1012.
27. Dhaliwal, M. K., Amandeep, Jagmohan., Manjeet. To compare the effect of proprioceptive neuromuscular facilitation program versus core stabilization exercise for decreasing pain and improving function in patients with low back pain. IOSR Journal of sport and physical education 2014; 1; 29-35.
28. Aziz, S., Ilyas, S., Imran S., Yamin F., Zakir A., Rehman A., Adnan S., Khanzada S. Effectiveness of Mc. Kenzie Exercise in Reducing Neck and Back Pain Among Madrassa Student. International Journal Physiotherapy 2016; 3 (1); 78-85.
29. Paatelma, M., Kiplikoski, S., Simonen, R., Heinonen, A., Alen, M., Videman, T. Orthopedic manual therapy, McKenzie method or advice only for low back pain in working adults: A Randomised controlled trial with one year follow-up. Journal of Rehabilitation Medicine 2008; 40; 858-863.
30. Bardin L, D., King P., Maher C, D. Diagnostic triage for low back pain: a practical approach for primary care. The Medical Journal Australia 2017; 6;206. doi: 10.5694/mja16.00828.
31. Sihawong, R., Janwantanakul, P., & Jiamjarasrangsi, W. A prospective, cluster-randomized controlled trial of exercise program to prevent low back pain in office workers. European Spine Journal 2014; 23(4); 786–793. https://doi.org/10.1007/s00586-014-3212-3.
32. Areeudomwong, P., Wongrat, W., Neammesri, N.,Thongsakul, T. 2016. A randomized controlled trial on the long-term effects of proprioceptive neuromuscular facilitation training on pain-related outcomes an back muscle activity in patient with chronic low back pain. Musculoskeletal Care, 2016. doi : 10.1002/msc.1165.
33. Mazloum, V., Sahebozamani, M., Barati, A., Nakhaee, N., Rabiei, P. The effect of Pilates and McKenzie exercise on quality of life and lumbar spine position sense in patients with low back pain: A comparative study with a 4-week follow-up. Intenational Journal of Medical and Health Sciences 2017; 11-12.

APPENDIX 1[29]

PNF PROCEDURE

Rhythmical Stabilisation Training (RST)

3 sets of 10 repetitions

Duration of 1 repetition: 10 seconds

Total duration of 1 session (including rest intervals): 20 minutes

1. Subject assumes a seated position and faces the physiotherapist.

2. The therapist places his or her hands on upper part of the scapula area, just below the shoulder level.

3. From this position, the subject is instructed to extension the trunk against resistance provided by the therapist.

4. The resistance slowly increases as the subject gradually increases strength.

5. When strength exertion is stabilized (for approximately 5 seconds), the therapist slowly moves one hand to the upper part of thoracic area, just below the shoulder level, aiming to provide resistance to the antagonist movement of the trunk (subject still extend the trunk).

6. When the subject responds to the new position, the therapist moves the other hand and instructs the subject to extend the trunk against the resistance provided.

Combination of Isotonic Exercises (COI)

3 sets of 10 repetitions

Duration of 1 repetition: 15 seconds

Total duration of 1 session (including rest intervals) approximately: 25 minutes

1. From the seated position, patient asked to flexion the trunk, then physiotherapist provide manual contacts on upper back. Then, the subject extend the trunk against manual resistance provided by the therapist's hands (5 seconds).

2. When optimal trunk extension (neutral sitting position) is achieved, the subject is instructed to maintain the position and the therapist also keep the resistance (5 seconds).

3. Upon maintenance of static position, the subject returns to the starting position (trunk flexion) against resistance provided by the therapist's hands with no change of manual contact (5 seconds).

MCKENZIE PROCEDURE

McKenzie Method Procedures

1. Lying Face down

Subject asked to stay on this position for 1- 2 minutes.

2. Lying Face down with Extension

Subject asked to start with lying face down position, then extension on elbow, hold on extension for 5 seconds then back to lying face down position for relaxation. Repeat for 10 times.

3. Extension on Lying

Subject asked to start with lying face down position, then continue to push-up position or maintain on last position for 10 seconds. Then back to lying face down position for relaxation. Repeat for 10 times.

4. Extension on Standing

Subject asked to start position with standing and place the subject's hand in small of the back and the fingers pointing backward. Then, subject asked to bend backward (extension) using hand as a fulcrum. Hold on extension for 5 seconds, then back to starting position and repeat for 10 times.

5. Flexion on Lying

Subject asked to start with lying on the back position with knee bent. Then, subject asked to flex the trunk with both knee to chest and hold the both knees with both hands. Hold 5 seconds and back to starting position for relaxation. Repeat for 10 times.

6. Flexion on Sitting

Subject asked to sit on the edge of chair. Then, bend the trunk forward and grasp the ankle or touch the floor with both hands. Hold for 5 seconds and repeat for 10 times.

7. Flexion on Standing

Subject starts with standing position, then asked to bend forward (flexion) with fingers down to the legs as far as subject comfortably reach. Hold for 5 seconds, then back to standing position and repeat for 10 times.

The subject was asked to do the whole session for two sets with 3 minutes rest interval.

Duration for 1 repetition: approximately 15 minutes

Total duration of 1 session (2 sets) including rest interval: approximately 30 minutes.

APPENDIX 2 [31]

HOME EXERCISE SHEET

EXERCISE FOR LOW BACK PAIN

An Educational Exercise Sheet

In recent years there has been a move towards more office-based jobs which has resulted in a nation of people who spend hours a day sitting stationary and hunched over in front of a desk. It is not surprising that a growing number of office workers complain of back pain. The lack of activity and movement as well as the bad posture associated with sitting in front of a desk all day means our backs are under a great deal of stress. However, despite this there are ways to protect your back from the strains of office work. Here are some tips on what you can do while at work to reduce the impact of back pain.

Forward bend
Bend forward and let your head and arms hang over your knees. Relax into the position and hold for a few seconds. Breathe in as you slowly come back up to seated position.

Spinal twist
Sit facing forward and place your left hand on the outside of your right knee. Place your right arm over the back of the chair. Twist to the right while turning your head. Push against your right knee to create more leverage. Hold the position. Release slowly and come back to facing forward and repeat on the opposite side.

Side stretch
Sit facing forward with feet slightly apart. Raise your arms out to the sides. Bend to the left, reaching toward the floor with your left hand and your right hand pointing toward the ceiling. Hold for a few seconds then come back to starting position. Repeat with your right side.

Knee squeeze
Place both hands around the front of your knee and pull your knee to your chest. Lower your head to your knee and hold for a few seconds then release slowly. Repeat with your right side.

Leg lifts
Sit and hold each side of the chair for balance. Lift your straightened left leg and flex your foot. Hold for a few seconds then slowly lower your leg. Repeat the same for your right leg.

Sun pose
Sit back in the chair with legs apart and arms by your side. With a sweeping motion bring your arms up over your head. Look up and stretch. Bend forward between your legs and if you can put your palms on the floor. Slowly rise back up with your arms over your head again, and then lower them to the side.

You can repeat all the session 5-8 repetitions.

In case if the subject requires any information or complaints due to treatment, subject may contact the physiotherapist or researcher through the following contacts:

KPJUC Rehabilitation Centre : 06-798 4450
Lucky Anggiat : 018-2569765
Madam Siti Nur Baait Binti Mohd Sokran : 012-3565325

Exercise booklet provided by : www.backcare.org.uk