

Effect of vertical oscillatory pressure on disability of patients with chronic mechanical low back pain using Roland Morris Disability questionnaire

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Abstract: Prevalence of low back pain (LBP) among Africans is rising. Many adults in any given year experience low back pain at one time or the other, this should be of concern. It is then imperative to research into how to reduce the disability caused by LBP. The objective of this study was to assess the effect of Vertical Oscillatory Pressure (VOP) on the pain and disability of patients with mechanical low back pain. A total of 84 patients (34 males and 50 females) diagnosed with mechanical low back pain were purposely selected to participate in the study after obtaining their consent. The pain intensity of all the patients was assessed individually using Present Pain Intensity (PPI) on the first day of their appointment in addition to other examinations. Roland-Morris Disability Questionnaire (RMDQ) was also administered to all patients individually on the first day of report to the clinic. This is pre test record. VOP was then administered to each patient twice in a week for 6 weeks making 12 treatment sessions. Pain intensity and disability were assessed regularly every week of appointment for the 6-week period using PPI and RMDQ (post-test) by another physiotherapist in order to avoid bias. The difference between the first week score of RMDQ and the 6th week score was calculated and the percentage of improvement was determined. Dependent t-test was used to compare the pre and post test values and an alpha level of 0.05 was set as level of significance. An independent t-test was used to analyse the difference between male and female values. Result revealed that the maximum complaint of patients using RMDQ showed a significant disability for males but not for females, and the rate of improvement of male was higher than that of females. There were significant differences ($P < .001$) between the pre-test and post test measurements of PPI and RMDQ, respectively. The rate of improvement in males was significantly higher than that of females. The study concluded that VOP can be useful in ameliorating pain and disability of patients with low back pain.

Keywords: back pain, vertical oscillatory pressure, pain intensity, Nigeria

Introduction

The health of Africans is of global concern, as improvement in health outcomes observed in most Western Countries over the past few decades has not been achieved in Africa (Lopez, 2006). Africa accounts for about 14% of the world's population, and it is also the poorest continent, bearing about 40% of the global burden of disease (Lopez, 2006). A positive causal relationship between income and health is well recognized internationally, in which a higher income promotes good health by the economical ability to access clean water and sanitation, good nutrition and good quality health services. Lack of access to these resources consequently predisposes communities to a greater prevalence of disease and disability (Bloom & Canning, 1999). The global prevalence of general disability is highest in Sub-Saharan Africa (Murray & Lopez, 1997). Musculoskeletal disorders are the most frequent causes of disability (WHO, 2003); they include osteoarthritis, rheumatoid arthritis, osteoporosis and low back pain (LBP). LBP results in significant levels of disability, producing significant restrictions on usual activity and participation, such as an inability to work (Katz, 2006). LBP are more prevalent among women than among men (LeResche, 2000).

The prevalence of LBP in Africa has been estimated at 12% among adolescents and 32% among adults (Louw *et al.*, 2007). In a study in south-western it was found that 40% of the population had LBP 12 months preceding the study 33% had low back pain at that time of the

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study (Omokhodion, 2002). Although the differential diagnosis of LBP is extensive, most symptoms have biomechanical causes and resolve promptly with little intervention, in which recurrence is common (Urquhart *et al.*, 2008; Henschk *et al.*, 2009). For individuals younger than 45 years, MLBP represents the most common cause of disability and is generally associated with a work-related injury. In individuals older than 45 years, MLBP is the third most common cause of disability, and a careful history and physical examination are vital to evaluation, treatment, and management (ICSI, 2005).

Different spinal manual therapy techniques have become an effective tool used in the management of LBP (Akinbo, 1998). The manipulative techniques that are employed usually are vertical oscillatory pressure (VOP), lumbar rotatory technique (Nwuga, 1998) spinal traction, rotation manoeuvres, flexion manoeuvre and hyper-extension (Akinbo, 1998).

Vertical oscillatory pressure is a derivative of manipulative therapy which applies a vertical manipulative gentle thrust on the vertebrae. Vertical oscillatory pressure is a technique used for the treatment of back pain (Nwuga, 1982). VOP has been reported to be an effective in relieving the pain of patients with mechanical low back pain (Nwuga, 2007). The use of pain intensity as an outcome measure has been common and a major way of assessing the effectiveness of VOP in LBP patients in Nigeria. The recent evidence based practice requires the assessment of patients' disability in addition to pain intensity for effective management of such condition especially in relation to MLBP.

One of the measures to assess disability of patients with low back pain is Roland-Morris Disability Questionnaire (RMDQ). RMDQ is a commonly utilised instrument for measuring spinal disability as an outcome measure (Roland & Morris, 1983a). It is a 24 items questionnaire that are most relevant to low back pain disability. RMDQ is easy to score by totalling the sum of circled items (maximum is 24) which represent the final score. Van Korff & Saunders (1996) mentioned that RMDQ citing a cut-off score of ≥ 14 represents a significant disability associated with an unfavourable outcome. The Roland Morris study was referred to as the best single study of assessing short-term outcome of primary care patients with low back pain (Van Korff & Saunders, 1996). This study was designed to assess the effect of VOP on the disability of patients with MLBP using RMDQ. Based on the relevance of the items of disability in RMDQ to the environment in which the study was carried out, RMDQ was selected to be used as an outcome measure for the study.

Material and Method

Subjects

The participants of this study were patients that were referred from the Orthopaedic Clinic to Physiotherapy Department of Obafemi Awolowo University Teaching Hospitals Complex, Ile Ife Nigeria, with symptoms of mechanical low back pain lasting for about 4 months. Patients with traumatic, infectious and cancerous LBP were excluded from the study. They were attending physiotherapy clinic for the first time. The age, sex, and marital status of each patient were recorded. In examining the patients, brief history of the origin and duration of the pain was taken and activities that aggravated the pain were noted. Relevant past medical history was also recorded. Specific examinations carried out were, trunk mobility test (i.e. movement of the trunk in forward flexion and backward extension, side flexion to right and to left, rotation to the left and right). Movements that elicited pain were noted because spinal pain of mechanical origin is reproduced by movement which induces tension and neural sliding (Shacklock, 1995). Lasegue's test and Ely's test were carried out according to Nwuga (2007) and were found to elicit pain at the lower back. X-ray and X-ray report of each patient did not indicate osteoporosis, carcinoma or pott disease, they showed degenerative changes between first lumbar vertebrae and sacral bones. Anterior-posterior pressure was applied to the low back from first lumbar vertebrae to the

sacral region while patient lying prone, any painful vertebrae was noted. Based on these findings VOP was chosen as a treatment of choice for the patients.

A total number of 84 (34 males and 50 females) patients were found suitable to participate in the study. This took a period of 8 months for the study to complete. The pain intensity of all the patients was assessed individually using Present Pain Intensity (PPI) on the first day they reported to the clinic. Similarly, Roland-Morris Disability Questionnaire (RMDQ) was administered to all patients individually. The content of RMDQ was explained to each patient. For the learned patients, they were given a copy of questionnaire to answer. Patient ticked “wrong” those disabilities that cannot be carried out and ticked “right” those disabilities that can be carried out. For those unlearned, each aspect of questionnaire was read and explained to each of them, patient then answered “yes” or “no” to the statement. That could be carried out was “yes” and it was ticked “right”. Those that could not be carried out were “no” and ticked “wrong”.

Digital pressure was applied to the lumbar vertebrae of each patient from Lumbar 1 to 5 in order to identify the painful area. The painful area was treated with Vertical Oscillatory Pressure only. The pressure was varied according to the tolerance of each patient and was oscillated for 20 to 30 seconds according to Nwuga (2007). Ice massage was applied for 2 minutes in order to prevent tissues reaction sequel to the pressure. The treatment was repeated two times in a week for 6 weeks. Patients did not involve in any other therapeutic intervention within the period of the study. However they were instructed in case there is exacerbation of pain they can take non-steroidal anti-inflammatory drugs or consult their doctor. But none of the patient reported increase in pain. RMDQ was administered again at the 6th week, but this was done by another member of investigation team to avoid bias. The number of “yes” were counted and recorded as well the 6th week of treatment (post –test). The percentage of improvement was calculated by subtracting the 6th week score of RMDQ from the first week. The number based on 24 was converted to percentage.

Ethical considerations

The study was approved by Ethic and Research Committee of Obafemi Awolwo University Teaching Hospitals Complex, Ile Ife. In addition, all the patients gave their consent to participate in the study.

Data analysis

The data was analysed using descriptive statistics and inferential statistics. The inferential statistics been used was dependent- t- test to compare the scores of RMDQ on the first day of appointment and the sixth week of treatment and to examine the difference between the PPI pre-test and post–test. Independent - t-test was conducted to assess the difference between the parameters of males and females patients.

Results

There were 84 patients (40.47% males and 59.53% females) that participated in the study. Their mean age was 53.37 ± 10.84 years. The mean weight was 68.46 ± 9.76 kg. The mean value of the height of males (1.67 ± 0.06 m) was similar to that of women; while the mean height for the total population was 1.59 ± 0.75 m. Men had a mean value of 26.6 ± 4.80 kg/m² of Body Mass Index while the mean value for that of female were 24.87 ± 3.91 kg/ m² and 24.89 ± 3.91 kg/m²for the total population (Table 1).

Table 1: Physical Characteristics of the patients (N = 84)

Variable	Male (N=34)		Female (N = 50)		Total (N= 84)	
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	t	P-value
Age in years	57.17± 7.25	51.10 ± 12.13	53.37 ± 10.84	53.37 ± 10.84	2.85	0.10
Weight (kg)	72.58 ± 10.80	66.00 ± 8.41	68.46 ± 9.76	68.46 ± 9.76	1.86	1.80
Height (m)	1.77 ± 0.06	1.67 ± 0.07	1.65 ± 0.06	1.65 ± 0.06	1.59	0.75
BMI (kg/m ²)	26.26 ± 4.80	24.87 ± 3.91	24.89 ± 3.91	24.89 ± 3.91	0.89	0.44
Waist C (cm)	89.42 ± 22.39	80.65 ± 22.60	83.94 ± 22.57	83.94 ± 22.57	1.07	0.82
Hip C (cm)	93.42 ± 20.50	89.60 ± 23.52	91.03 ± 22.17	91.03 ± 22.17	0.47	0.67
WHR	0.96 ± .07	0.90 ± .07	0.92 ± .08	0.92 ± .08	2.12	0.70

Key: BMI = Body Mass Index; Waist C = Waist circumference; Hip C = Hip circumference; WHR = Waist to Hip Ratio

On the first day of visitation to the department, the minimum complaint using RMDQ for male was 3 and the maximum complaint was 14 while that of the females were 5 and 13 first and sixth week, respectively. At the sixth week, the minimum complaint for males was 0 and the maximum complaint was 4 but that of women were 1 and 5 minimum and maximum, respectively (Table 2).

Table 2: Summary of patients' complaint using RMDQ and PPI (N=84)

Variable	Male (N = 34)			Female (N=50)		
	Min	Max	Mean± SD	Min	Max	Mean± SD
RM1STWK	3.0	14.0	8.90 ± 6.00	5.0	13.0	2.31 ± .85
RM6THWK	0.0	4.0	2.03 ± 1.79	1.0	5.0	2.32 ± .87
RIMPRT	73.0	100.0	96.45 ± 11.98	64.29	83.33	76.57 ± 4.96
PPI1WK	3.0	3.0	3.00 ± 0.0	3.0	4.0	3.58 ± .47
PP14WK	0.0	1.0	0.81 ± .35	0.0	2.00	0.94 ± .56

Key: RM 1ST WK = Score of RMDQ first day of appointment; RM6THWK = Score of RMDQ at 6th week of treatment; RIMPRT = Percentage of improvement using RMDQ; PPI1WK = Present Pain Intensity 1st week of treatment; PPI4WK = Present Pain Intensity 6th week of treatment

The rate of improvement for males was 73% minimum and 100% maximum and the mean was 96.45%±11.98 while that of women was 64.29% as minimum and 83.33% as maximum with the mean value of 76.57%±4.96. Present pain index was 3 for both minimum and maximum for the males and 3 and 4 for maximum and minimum, respectively for females, the mean value was 3.58±0.47. The PPI at the 6th week was 0 minimum and 1 maximum with the mean difference of 0.81±0.45 for males and 0 minimum and 2 maximum with the mean value of 0.94 + 0.76 for females.

Table 3: Dependent –t-test showing the difference between RMDQ and PPI at 1st and 6th week of the treatment

	1 ST Week		6 TH Week		t	P-value
	Mean + SD	Mean + SD	Mean + SD	Mean + SD		
RMQD	8.90 ± 6.00	2.03 ± 1.79	2.03 ± 1.79	14.75	0.00	0.00
PPI	3.00 ± .00	.61 ± .40	.61 ± .40	27.86	0.00	0.00

There was a significant difference (t=14.75, P<0.001) between the values of RMDQ before the treatment and after 6 weeks of treatment. In addition there was a significant difference (t = 27.86, P<0.001) in the mean value of PPI before the treatment and after the treatment (Table 3). The difference between male and female rate of improvement using RMDQ and PPI is shown in Table 4. There was a significant difference (t = 5.89 P< 0.001) in the percentage of improvement when RMDQ of males and females were compared.

Table 4: Independent –t-test to compare the difference between the improvement of male and female after 6th week of treatment

Variable	Male n=34 Mean ± SD	Female n= 50 Mean ± SD	t	P-value
RMDQ	2.03 ± 1.01	2.32 ± 1.99	2.64	0.692
RIMPRT	96.45 ± 11.98	76.58 ± 4.99	5.89	0.000
PPI	0.81 ± .35	0.94 ± .56	.892	0.574

Discussion

The higher number of female MLBP patients that reported to the clinic within the period of the study than that of male was supported by the work of Soetanto *et al.* (2006) who reported that women reported more pain compared to men and women had a lower threshold and tolerance for pressure pain. This may also be responsible for why the maximum value of PPI for females was more than that of males in this study. Similarly, others studies (LeResche, 2000; Riley *et al.*, 1998) found that many painful diseases such as rheumatoid arthritis, migraine headache, and low back pain are more prevalent among women than among men. Considering the physical characteristics of the patients, it was observed that the mean value of BMI for male patients fell in the overweight category (>25 kg/m²) while that of women did not. The findings of this study for males were in agreement with the study by Heliovaara (1980), who reported that excessive weight increases the weight on the spine and pressure on the discs and other structures of the back, and lumbar disc herniation may occur. The finding on the women was also in agreement with the work of Yip *et al.* (2001). They observed in their study that being overweight was found to have no association with LBP. Similarly a number of studies on the relationship between being overweight (in term of body mass index) and the occurrence of LBP have shown conflicting results (Pope *et al.*, 1985; Deyo & Bass, 1989; Orvieto *et al.*, 1984). With respect to waist to hip ratio, the higher value observed in this study was in line with the work of Yip *et al.* (2001). They observed that a high waist to hip ratio was associated with a lower risk of severe LBP.

With regard to the effect of VOP on the pain of the patients, it was observed from the result that there was a significant reduction in the pain intensity and disability of the patients. Various forms of oscillatory techniques have been employed to treat conditions such as cervical pain, parasthesia in both arms, pain in the left shoulder and unilateral or bilateral low back pain (Nwuga 1990). The findings of our study support other studies that pain intensity, forward and side flexion in elderly are improved by VOP and should be the preferred spinal mobility (Onuwe, 1998; Egwu *et al.* 2007). In addition many other studies (Nwuga & Fajewonyomi, 1979; Nwuga, 1982; Kenna & Murtagh, 1989) had also proved that spinal manual therapy offers significant greater pain relief compared to the traditional or conventional modalities. In the treatment of back pain, spinal manual therapy especially vertical oscillatory pressure will cause stimulation of the afferent fibre connected to the large diameter nerves to produce neuro-physiological effect which cause pain relief (Jones *et al.*, 1990; Hill, 1990; Nwuga, 1993).

Physiological evidence shows that ectopic discharge of noxious impulses from nerve irritation sustains pain by triggering or enhancing sinusoidal voltage oscillation in dorsal root ganglion membrane potential (Amir & Devor, 1997; Amir *et al.*, 1999; Skyba *et al.*, 2003). Skyba *et al.*, (2003) observed that joint manipulation produced anti-hyperalgesia via descending inhibitory mechanism that utilizes serotonin and noradrenaline. Therefore VOP may decrease mechanical pressure generated by inflammation and collagen deposits on soft tissues in and around the intervertebral foramen to restore mobility while descending electrical activity in type III and IV fibres through normalization of blood flow and vertebral alignment. Oscillation to the pressure – pain threshold may generate sufficient wide dynamic range neuron modulation of nociceptor-specific neurons, down tune the amplitude of sinusoidal-voltage oscillation in membrane to decrease muscle spasm and hyper-excitation leading to analgesia and recovery function (Gilete,

1993; Shaklock, 1995; Devor, 1998; Naguszewski et al., 2001; Croft et al., 2006). There was a significant difference between the mean values of male and female percentage of improvement using RMDQ. The male percentage of improvement was found to be higher than that of females. However, there is paucity of data in the literatures to support this finding. The effect of gravity on the body weight might be a contributory factor. The mean value of the weight of male patients was found higher than that of female but there was no significant difference when comparing the two. In addition the interaction of gonadal hormones with pain mechanisms which has been found to increase pain sensitivity in women (LeResche, 2000; Unruh, 1996) might be responsible for prolonging improvement when compared with men.

In conclusion, the study has shown that VOP is effective in the management of pain in patients with low back pain and can effectively relieve disability especially those listed in the RMDQ of patients with low back pain.

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