

## A comparative study of the therapeutic efficacy of vertical oscillatory pressure and transverse oscillatory pressure in the management of chronic low back pain

### Estudo comparativo da eficácia terapêutica da pressão oscilatória vertical e da pressão oscilatória transversa no manejo da dor lombar crônica

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**RESUMO | INTRODUÇÃO:** O uso de modalidades físicas para o tratamento da Dor Lombar Crônica (DLC) é potencialmente benéfico, porém, a evidência geral ainda deixa dúvidas sobre sua aplicação segura. **OBJETIVO:** Este estudo buscou investigar e comparar a eficácia relativa da Pressão Oscilatória Vertical (POV) e da Pressão Oscilatória Transversal (POT) no manejo da Dor Lombar Crônica (DLC) de origem mecânica. **MÉTODOS:** Foi utilizado um delineamento quasi-experimental de dois grupos, envolvendo um total de quarenta e dois participantes selecionados com a devida consideração dos critérios específicos de inclusão e exclusão. Cinco questões de pesquisa foram levantadas com hipóteses correspondentes formuladas para eles, que foram testadas no nível de significância de 0,05. Os participantes foram distribuídos aleatoriamente para o grupo POV e POT, e foram posteriormente acompanhados três vezes por semana por um período de seis semanas. A classificação da intensidade da dor, elevação da perna estendida e amplitude de movimento da coluna vertebral foram as medidas de desfecho selecionadas, que foram avaliadas antes e após o tratamento. Os dados foram coletados, organizados e analisados por meio de estatística descritiva e a inferência pelo test T de Student. **RESULTADOS:** Os resultados do estudo mostraram uma diferença significativa em cada uma das medidas de desfecho para ambos os grupos ( $p < 0,05$ ). **CONCLUSÃO:** Isso sugere que tanto a POV quanto a POT foram relativamente eficazes no gerenciamento de DLC.

**PALAVRAS-CHAVE:** Dor Lombar. Fisioterapia. Terapia manual.

**ABSTRACT | BACKGROUND:** The use of physical modalities in treatment of Chronic Low Back Pain (CLBP) is potentially beneficial, but the general evidence still leaves questions about its security application. **OBJECTIVE:** This study sought to investigate and compare the relative efficacy of Vertical Oscillatory Pressure (VOP) and Transverse Oscillatory Pressure (TOP) in the management chronic low back pain (CLBP) of mechanical origin. **METHODS:** A two-group, quasi-experimental design was utilized, involving a total of forty-two participants purposively recruited with due consideration of the specific inclusion and exclusion criteria. Five research questions were raised with corresponding hypotheses formulated for them, which were tested at 0.05 level of significance. The participants were randomly assigned to the VOP and TOP groups, and were subsequently managed thrice weekly for a duration of six weeks. The pain intensity rating, straight leg raising, and spinal range of motion were the outcome measures selected, which were assessed before and after treatment. Data were collected, organized, and analyzed using descriptive and T-Student test analytical statistics. **RESULTS:** The results of the study showed a significant difference in each of the outcome measures for both groups ( $p < 0,05$ ). **CONCLUSION:** This suggested that both VOP and VOP were relatively effective in managing CLBP.

**KEYWORDS:** Low back pain. Physiotherapy. Manual therapy.

Low back pain (LBP) is one of the most frequent conditions seen in clinical practice, and a leading cause of disability worldwide<sup>1-2</sup>. Muscular strain, ligament sprain, degeneration of the intervertebral discs, compression of nerve roots, poor lifting postures, among other causes have been suggested as the commonest etiology of LBP<sup>3</sup>. Most cases of lbp are not severe and usually resolves in a matter of days or few weeks. Sometimes, the condition may become recurrent or chronic in about 6% to 10% of patients<sup>4</sup>. The pain experienced could be diffused or localized, which may or may not radiate to the lower limb(s) of the sufferer<sup>5</sup>.

It has been estimated that 80% of the general population will experience a back problem at some point in their lives<sup>6</sup>. Across the populace, the elderly people, sedentary workers, professional drivers, weight lifters, industrial or manual workers, and nurses are more prone to developing back pain<sup>7</sup>. Chronic low back pain (CLBP) is associated with decreased physical performance, exacerbated nociceptive sensations, increased anxiety levels, depression, impaired social functioning, and sleep disturbances<sup>8-9</sup>.

Managing chronic low back pain (CLBP) could be problematic if the cause is unknown<sup>10</sup>, therefore, accurate diagnosis is key in its management. There is moderate evidence that multidisciplinary treatment, though very expensive has yielded considerable improvements in pain and daily functioning of people suffering from CLBP<sup>11</sup>. The use of physical modalities in treating CLBP is potentially beneficial<sup>12</sup>, but there is a mixed overall evidence. Spinal manipulative therapy (SMT) is a popular and well researched conservative management of CLBP which has been shown to be an effective intervention for CLBP sufferers, even though there are different recommendations in clinical guidelines as regards to its utilization in practice<sup>13,14</sup>.

The main objective of this study was to investigate and compare the therapeutic effects of two forms of SMT; vertical oscillatory pressure (VOP) and transverse oscillatory pressure (TOP) techniques in the management of mechanical CLBP following six weeks of treatment.

A two-group quasi-experimental design was selected for this study. Patients who were on regular course of treatment with chemotherapy (analgesics and muscle relaxants) were excluded from the study. Other exclusion criteria were: pregnancy, history of tumour, severe cardiorespiratory and metabolic diseases, poorly controlled vital signs. The inclusion criteria were: participants should be above eighteen years, they must have had mechanical CLBP, and must not have received SMT before. Ethical clearance certificate was obtained from the Obafemi Awolowo University Teaching Hospitals Complex's Research and Ethical Committee, Ile-Ife, Osun state, Nigeria, and informed consent forms were completed by the participants before the commencement of this study.

Forty-two patients (18 males and 24 females) referred from the Orthopaedics Department of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Osun state, Nigeria to the Physiotherapy Department of the same establishment were purposively recruited for this study. Prior to their treatment, each of the participants was made to undergo thorough clinical assessments. These included a detailed medical history (past and present), examination of the spine for any spinal deformity, and other investigations relevant to their condition. The outcome measures for this study were the pain intensity ratings (using a pain numerical rating scale)<sup>15</sup>, the degree of hip flexion (using straight leg raising test)<sup>16</sup>, and the spinal range of motions (SROM) in extension, forward flexion, and lateral flexion<sup>17-18</sup>. At the end of the preliminary screening, all the participants were assigned to either the VOP or the TOP group by a stratified random sampling technique.

VOP was administered on twenty-one participants (9 males and 12 females). This procedure was done as described by Nwuga<sup>19</sup>. Each participant adopted a prone position on the treatment couch, with the forehead resting on the back of the hands. The physiotherapist stood on a small platform by the side of the treatment couch for easier leverage while performing the VOP technique. He first located the painful area on the participants' spine, placed his two thumbs in a longitudinal fashion on the spinous process of the lumbar vertebra(e) which were of

concern to him. This manipulation involved a vertical rhythmic pressure-release sequence on the spinous process of the vertebra(e) with the thumbs pointing to each other along the spine. The pressure came from the physiotherapist's trunk, transmitted down his straight arms to the thumbs. Five sets of oscillatory movements, each lasting for thirty seconds were administered on each participant thrice a week for six weeks duration. This cumulated to 12 treatment sessions for each participant.

TOP was administered on twenty-one participants (9 males and 12 females). This procedure was also done as described by Nwuga<sup>19</sup>. Each participant adopted a prone position on the treatment couch, with the forehead resting on the back of the hands. Standing on the side of the patient, the therapist placed his thumbs in a longitudinal fashion against the left side or the right side (depending on the location of the pain) of the spinous process of the lumbar vertebrae to be moved. Treatment was effected by a push-relax sequence on the spinous process using the thumbs to produce an oscillatory movement. Movement was initiated from the trunk

and transmitted down the arm to the thumbs. Five sets of oscillatory movements, each lasting for thirty seconds were administered on each participant thrice a week for six weeks duration. This also cumulated to 12 treatment sessions for each participant. It should be noted that the outcome measures were assessed on a weekly basis in both groups. T Student test was used to compare means of pain intensity, of straight leg raise and spinal flexion, pre and post treatment, using alpha of 5% and power of 80%.

## Results

A total of 42 participants were recruited for this study with 21 participants (9 males and 12 females) randomly assigned to each group (VOP and TOP). The mean age in the VOP group was 49.48 years  $\pm$ 13.51 with a range of 28-73 while the mean age in the TOP group was 45.52 years  $\pm$  12.30 with a range of 29-82. The sample was similar in both groups in relation to demographic characteristics (Table 1).

**Table 1.** Demographic characteristics of the participants. Osun, Nigeria, 2017.

Group	Participants	Age range (years)
VOP	21 (9M & 12F)	28-73
TOP	21 (9M & 12F)	29-82

M = Males; F = Females.

The pre-treatment mean pain (first week) in the VOP group was 7.86  $\pm$  1.78 while the post-treatment mean pain (after sixth week) was 2.76  $\pm$  1.88. In the TOP group, the pre-treatment mean pain was 8.29  $\pm$  2.05 while the post-treatment mean pain was 2.91  $\pm$  1.44. Independent samples t-test was used to determine the difference in the participants' mean pain intensity over the course of six weeks. The p-values were found to be statistically significant at 0.05 level of significance in both groups (Table 2).

**Table 2.** Comparison of pre- and post-treatment values of mean pain intensity in both groups. Osun, Nigeria, 2017.

Group	Pre-treatment mean pain	Post-treatment mean pain	Df	t-value	p-value
VOP	7.86	2.76	40	8.95	< 0.05
TOP	8.29	2.91	40	9.78	< 0.05

T Student Test.

The pre-treatment mean straight leg raise (first week) in the VOP group was  $13.27 \pm 1.92$  while the post-treatment mean straight leg raise (sixth week)  $48.96 \pm 7.50$ . In the TOP group, the pre-treatment mean straight leg raise (first week) was  $12.83 \pm 1.83$  while the post-treatment mean straight leg raise (sixth week) was  $59.41 \pm 20.59$ . Independent samples t-test was used to determine the difference in the participants' mean straight leg raise over the course of six weeks. The p-values were found to be statistically significant at 0.05 level of significance in both groups (Table 3).

**Table 3.** Comparison of pre- and post-treatment values of mean straight leg raise in both groups. Osun, Nigeria, 2017.

Group	Pre-treatment mean straight leg raise (cm)	Post-treatment mean straight leg raise (cm)	Df	t-value	p-value
VOP	13.27	48.96	40	21.12	< 0.05
TOP	12.83	59.41	40	2.29	< 0.05

T Student Test.

The pre-treatment mean spinal flexion (first week) in the VOP group was  $2.67 \pm 0.78$  while the post-treatment mean spinal flexion (sixth week) was  $5.67 \pm 0.78$ . In the TOP group, the pre-treatment mean spinal flexion (first week) was  $2.62 \pm 0.73$  while the post-treatment mean spinal flexion (sixth week) was  $4.57 \pm 1.80$ . Independent samples t-test was used to determine the difference in the participants' mean spinal flexion over the course of six weeks. The p-values were found to be statistically significant at 0.05 level of significance in both groups (Table 4).

The pre-treatment mean spinal extension (first week) in the VOP group was  $2.24 \pm 0.61$  while the post-treatment mean spinal extension (sixth week) was  $4.29 \pm 0.76$ . In the TOP group, the pre-treatment mean spinal extension (first week) was  $1.91 \pm 0.78$  while the post-treatment mean spinal extension

(sixth week) was  $3.52 \pm 1.86$ . Independent samples t-test was used to determine the difference in the participants' mean spinal extension over the course of six weeks. The p-values were found to be statistically significant at 0.05 level of significance in both groups (Table 4).

The pre-treatment mean lateral flexion (first week) in the VOP group was  $4.86 \pm 0.70$  while the post-treatment mean lateral flexion (sixth week) was  $6.80 \pm 1.87$ . In the TOP group, the pre-treatment mean lateral flexion (first week) was  $4.60 \pm 0.82$  while the post-treatment mean lateral flexion (sixth week) was  $8.44 \pm 1.11$ . Independent samples t-test was used to determine the difference in the participants' mean lateral flexion over the course of six weeks. The p-values were found to be statistically significant at 0.05 level of significance in both groups (Table 4).

**Table 4.** Comparison of pre- and post-treatment values of mean spinal flexibility in both groups. Osun, Nigeria, 2017.

Group	Pre-treatment mean spinal flexion	Post-treatment mean spinal flexion	Df	t-value	p-value
<b>Spinal Flexion</b>					
VOP	2.67	5.67	40	12.00	< 0.05
TOP	2.62	4.57	40	4.43	< 0.05
<b>Spinal Extension</b>					
VOP	2.24	4.29	40	9.32	< 0.05
TOP	1.91	3.52	40	3.66	< 0.05
<b>Spinal Lateral Flexion</b>					
VOP	4.86	6.80	40	4.41	< 0.05
TOP	4.60	8.44	40	12.00	< 0.05

T Student Test.

## Discussion

This study compared the therapeutic efficacy of vertical oscillatory pressure (VOP) and transverse oscillatory pressure (TOP) on participants with chronic low back pain following six weeks of management. The outcome measures used for the study included the pain intensity rating, the degree of hip flexion using straight leg raise test, and the spinal range of motion in forward flexion, extension, and lateral flexion. The results of the independent groups t-test led to the rejection of the null hypotheses saying that there would be no significant differences between the pre- and post-treatment pain perception, degree of hip flexion, and spinal range of motion in both groups after six weeks of treatment.

The statistical difference in these outcome measures before and after treatment in each group showed that both techniques were quite effective in relieving CLBP. This findings corroborated previous studies which reported that both VOP and TOP techniques are effective in the management of LBP<sup>19</sup>.

Although there is low-to very low-quality evidence suggesting no difference in effect for spinal manipulative therapy when compared with other interventions<sup>20</sup>, manual therapy provides some economic advantage relative to other interventions used for the management of low back pain, indicating that some manual therapy techniques may be more cost-effective than usual care<sup>21</sup>.

Significant treatment effects have been found favouring a sub-group specific with manual therapy at immediate and intermediate follow-up. It was a limitation not using recommended rating<sup>22</sup>. It may be possible that every participant of this small sample were exactly the part of people who present the best results.

## Conclusion

Based on the effect of these two forms of spinal manipulative therapy in the management of chronic low back pain, it was concluded that these techniques were quite effective and safe for the participants going by the outcome of this study. It is therefore recommended that physiotherapists should embrace and acquire spinal manipulative therapy skills. Future replication of this work and other related studies, involving a larger sample size are required for further generalization.

## Author contribution

Olufemi OO and Oluwadare OA both participated in the conception and planning of the work that led to the manuscript or acquisition, analysis and interpretation of the data, drafting and critical revision of the manuscript for important intellectual content and approval of the final submitted version of the manuscript.

## Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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