

Efficacy of Six Weeks Infrared Radiation Therapy on Chronic Low Back Pain and Functional Disability in National Orthopaedic Hospital, Enugu, South East, Nigeria

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ABSTRACT

BACKGROUND

Infrared radiation therapy is a modality widely used in Physiotherapy for the management of pain. The objective of this study was to determine the efficacy of six weeks infrared radiation therapy on pain intensity and functional disability index in subjects suffering from non-specific low back pain

METHODS

The study was a pre-test post-test two group pre-experimental design. A total of fifty subjects (26 males and 24 females) of black African origin clinically diagnosed with non specific chronic low back pain that met the inclusion criteria were recruited for the study, but only 44 subjects (26 males and 18 females) completed the six weeks study. The subjects received infrared radiation therapy on the lower back region in prone lying for 30minutes, three times weekly, during the treatment period, for six weeks. Subjects' pre and post treatment pain level and functional disability scores were assessed using the 10point numerical rating pain scale and the Oswestry disability index questionnaire. The data was analyzed using the Students' t-test.

RESULTS

Findings from the study showed significant decrease in the means of the pre-test and post-test scores of the variables by 95% C.I at $p < 0.05$.

CONCLUSION

Six weeks infrared radiation therapy is effective in reducing pain and improving functional disability index in chronic low back pain.

KEYWORDS

Chronic low back pain, pain intensity, functional disability, infrared radiation therapy

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INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or an unpleasant emotional state felt in the mind but identifiable as arising in a part of the body¹. Back pain is a musculo skeletal disorder with a high prevalence worldwide and a common cause for functional disability among the working population often with a negative psychological impact on its sufferers and a reason for intermittent absenteeism from work²⁻⁵. Low back pain is defined as the tension, soreness and stiffness in the lower back region for which it is not probable to identify a specific cause⁶. It

is classified as acute < 6weeks, sub-acute 6-12 weeks and chronic >12weeks.

Low back pain is the leading cause of limitation in activity of daily living, reduces health related quality of life, and causes important health care expenses⁷. A disability is any restriction or lack (from impairment) of the ability to perform an activity in the manner or within the range considered normal⁸. It may also be described as a restriction that affects the functional ability and working status of the young and adult population^{9,10}. Disability which often accompanies low back pain, varies in extent and may be temporary or even permanent as seen in chronic back pain where it is ongoing and difficult to manage^{11,12} because other factors besides pain such as psychological factors are involved^{13,14}.

Infrared radiation therapy (heat therapy) is a physical therapy intervention modality classified under thermotherapy which is used in the treatment of low back pain. Infrared(IRR) is the electromagnetic radiation with longer rays than visible light shorter rays than a microwave but lying within the electromagnetic spectrum. IRR rays gives rise to heat when absorbed by matter, between the wavelengths of 4×10^3 Hz and 7.5×10^4 Hz. The heat emitted from IRR has been shown to increase tissue extensibility, improves joint range of motion, decreases pain and enhance healing of soft tissue lesions¹⁵⁻¹⁷. These actions are mediated through its physiologic effects of heating which results in a general increase in cell activity and blood flow and a reduction in the level of pain and decrease in metabolites such as bradykinin and histamine¹⁵.

Infrared radiation is produced in two forms as luminous and non -luminous radiations. To facilitate changes within the body tissues, absorption depends on the structure, type, vascularity and pigmentation of the body tissues. Energy penetration into a medium is dependent upon the intensity of the Infrared source. Maximal penetration occurs with wavelengths of 1.2mm, where the skin is

usually opaque to wavelengths of 2mm and more¹⁸. In acute inflammatory conditions, the non-luminous generator may be used because of the sedative effect of the rays which may be effective in relieving pain, than the counterirritant effect produced by the shorter rays of the luminous generator which is more effective in lesions of a chronic nature¹⁸.

Different results from trials involving infrared radiation therapy have provided conflicting evidence on its efficacy and this has further been interpreted within the clinical guidelines as an ineffective intervention in the management of chronic low back pain¹⁹⁻²⁴. Nourredinet al.²⁵ documents statistically significant evidence on the efficacy of infrared therapy on all outcome measures as pain intensity, functional disability and mobility. All the studies conducted to determine the efficacy of infrared therapy in chronic low back pain management have been carried out in Whites and Asian population. It is therefore important to determine its efficacy on pain management and functional disability among black African adults.

MATERIALS AND METHODS

- **Study design:** In this present study two groups pre-test post-test pre experimental design was used to determine the effect of IRR on pain intensity and functional disability on chronic low back pain
- **Subjects:** The population for the study was subjects with the diagnosis of non-specific low back pain attending the National Orthopaedic hospital, Enugu (NOHE), Nigeria. Fifty subjects (26 males and 24 females) of black African origin that met the inclusion criteria were recruited for the study, but only forty- four subjects (26 males and 18 females) completed the six weeks study. The subjects' age ranged from 24years to 55years. Subjects were fully informed about the experimental procedures, risks, and protocol after which they gave their written informed consent.

- **Inclusion criteria:** subjects who freely volunteered, with chronic low back pain \geq 12weeks of non-specific origin, of African(Nigerian) origin. Subjects on similar NSAIDS were also recruited.
- **Exclusion criteria:** All subjects with diagnosis of low back pain of traumatic origin, chronic pain \leq 12weeks,impaired sensory ability, of non -African origin, neurological and metabolic diseases, and those on other forms of Physiotherapy intervention and drugs outside NSAIDS.

PROCEDURES

- **Pre-treatment procedure:** The subjects' pain intensity levels prior to intervention was assessed using the 10 point Numerical Pain Rating Scale, while the Oswestry disability index questionnaire was used to measure the functional disability index of the subject.
- **Treatment procedure:** The ethical approval of the Research and Ethics committee ofNOHE was sought and obtained before the study commenced, while individual patient's informed consent was duly obtained before their participation. Infrared therapy was applied to subjects' low back region in prone lying, after being tested for thermal sensation using test tubes containing cold and warm water respectively. The patients' low back region was cleaned using methylated spirit and cotton wool prior to IRR treatment. The experimental group received only IRR for 30minutes, at a distance of 65cm, 3 times a week for six weeks, while the control group was only on NSAIDS (diclofenac 50 to 200mg trice daily, ibuprofen 600-800mg 4 hourly) as prescribed by the Orhopaedic surgeons. All patients were advised not to engage on any strenuous exercise through the period of the treatment.
- **Post-test procedure:** post-tests pain and functional disability index

assessment was also conducted using the Numerical Pain Rating Scale and the Oswestry disability index questionnaire.

Limitations

- The study was not blinded and this may have created bias. The subjects and control were also not matched for age. The mean age of the exercise group was higher than that of the control, there should be a statistical significant difference in age of both groups which may have resulted in any difference in response.
- The effects of placebo IRR could not be carried out in this study, due to ethical reasons, considering that the study was longitudinal.

Statistical analysis

The data collected was analyzed using inferential statistics. Paired sample t-test was used to find the differences between pre and post treatment measurements of pain and disability index. All statistics was performed using the statistical package for social sciences (SPSS; Version 20.0). The probability level for all the above tests was set at $p < 0.05$ level of significance.

RESULTS

Table 1: Subjects' physical characteristics (N = 44)

Variables	Ex Grp (N = 24)	Cntl Grp (N = 20)	Total
	Mean + SD		
Age (years)	50.04 + 8.79	40.00 + 10.24	45 + 10.64
Height (m)	1.57 + 0.04	1.58 + 0.03	1.57 + 0.41
Weight (Kg)	62.08 + 5.77	60.70 + 4.93	61.45 + 5.38

Ex Grp = Exercise group; Cntl Grp = Control group.

The results on the subjects' physical characteristics show that the mean + SD values for exercise and control groups were Age 50.04 + 8.79 Ex Grp; 40.00 + 10.24 Cntl Grp; Height 1.57 + 0.04Ex Grp; 1.58 + 0.03

Cntl Grp; and weight 62.08 + 5.77 Ex Grp; 60.70 + 4.93 Cntl Grp. The mean age of the exercise group was higher than that of the control.

Table 2: Pre and Post treatment mean + standard deviation (SD) pain, functional disabilities and Students' t- test values (N = 44)

Variables	Mean	SD	t-value	p-value
Pre pain Ex Grp	6.17	1.36	10.89	0.001*
Post pain Ex Grp	4.12	1.51		
Pre pain Cntl Grp	6.16	1.37	11.21	0.001*
Post pain Cntl Grp	4.35	1.04		
Pre DI Ex Grp	24.58	6.71	25.00	0.001*
Post DI Ex Grp	22.50	6.67		
Pre DI Cntl Grp	26.65	10.38	21.00	0.001*
Post DI Cntl Grp	24.55	10.46		

DI= Disability index.

The results on pre and post treatment mean + SD pain and disability index (DI) of the subjects in exercise and control groups were: 6.17 + 1.36; 4.12 + 1.51 Ex Grp pain; 6.16 + 1.37; 4.35 + 1.04 Cntl Grp pain; 24.58 + 6.71; 22.50 + 6.67 Ex Grp DI; 26.65 + 10.38; 24.55 + 10.46 Cntl Grp DI. There were statistical significant decrease in pain intensity and DI in both the experimental and control groups ($p < 0.05$).

DISCUSSION

There is paucity of literature on the efficacy of infrared radiation therapy on pain and disability especially among black African subjects with chronic low back pain. The subjects' age range was 24 years to 55 years with mean age of 45 years. Forty four subjects (26 males and 18 females) completed the six weeks study. The pretreatment mean pain intensity was 6.17 for exercise group and 6.16 for control group. The pretreatment DI was 24.58 for exercise group and 26.65 for the control. A clinical study on therapeutic effects of near infrared radiation on chronic neck pain conducted in Taiwan²⁶ shows that the subjects' age range was 20 years to 65 years. Another clinical study by Gale²⁷ on the effects of infrared therapy on chronic LBP in Ontario showed that the subjects' age range was

26years to 80 years, while mean pretreatment pain intensity was 6.9 in the treatment group and 7.4 in the placebo group. The age range of the subjects who participated in this current study was lower than those in the two studies^{26,27}. This shows that people of younger age may be at risk of having non specific chronic low back pain (CLBP) in Nigeria.

Results of the present study showed that there was a significant reduction in pain intensity and functional disability in both the experimental and control groups. This means that both IRR and NSAIDs were very effective in reducing pain in patients suffering from non specific CLBP. The beneficial effect of infrared radiation therapy on chronic low back pain and functional disability as seen in this present study may be related to the hypothesized theory that infrared radiation therapy reduces pain intensity by, vascular changes in blood flow, reflex activity, possibly through the activation of pain gate theory and also through reducing muscle spasm associated with it²⁸

Similar findings were reported by Nouredinet al.²⁵ who demonstrated that infrared therapy is significantly effective in the treatment of pain. The results were also partly supported by Nadler et al²⁹ who also found that IRR was effective in relieving pain, but claimed that it was more effective than NSAIDs in treatment of CLBP. In this current study both IRR and NSAIDs had significant effects in pain reduction.

Gale et al.²⁷ and Nadler et al.³⁰ further corroborated these findings from their studies which showed significant effect of infrared therapy in pain reduction from CLBP. Frenchet al.³¹ documented moderate evidence in the use of superficial heat using IRR as a pain relief modality in CLBP. Their findings agreed with the results of this study. Also similar studies by Chen et al.²⁶ and Nuhr et al.³² supported the findings of this study. In contrast, Youssefi-Nooraie et al³³ concluded that infrared radiation therapy was of "no effect".

CONCLUSION

These findings show that six weeks use of infrared radiation therapy in the treatment of chronic non-specific low back pain results in a significant decrease in pain intensity and an improvement in the functional disability index among black subjects of African origin.

Practical Application

Physiotherapists should continue to use IRR either alone or alongside drug therapy in the management of non specific CLBP. Further studies are being recommended on placebo effect of IRR, responses of biomarkers of inflammation and opioids to IRR therapy.

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