VOLUME 3, DEC. 2010

GHANA JOURNAL OF HEALTH, PHYSICAL EDUCATION, RECREATION, SPORTS AND DANCE (GJOHPERSD)

GHANA JOURNAL OF HEALTH, PHYSICAL EDUCATION, RECREATION, SPORTS AND DANCE (GJOHPERSD)

Volume 3 Dec., 2010

A JOURNAL OF THE DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION (HPER)
UNIVERSITY OF CAPE COAST
GHANA, WEST AFRICA

ISSN 0855-1154

Published By:
Department of Health, Physical Education and Recreation (HPER)
University of Cape Coast, Ghana, West Africa

Printed By
University Printing Press, Cape Coast
(03321-30861)

Efficacy of Therapeutic Exercise and Electrical Stimulation on Angle Range of Motion of Sciatic Nerve Injection Injury

***Oladipo, I. Oladele**
****Davis, O. Abigael**
*Department of Human Kinetics and
Health Education University of Ibadan, Nigeria
**Physiotherapy Department Federal Medical
Centre, Abeokuta, Ogun State, Nigeria

Abstract

The study compared the effectiveness of therapeutic exercise and electric stimulation to increase the range of motion on Sciatic Nerve Injection Injury (SNII). The pretest post-test design was employed. Subjects were thirty SNII patients aged 3-8 years. They were randomly assigned to three treatment groups: Therapeutic Exercise, Electrical Stimulation and, Therapeutic Exercise and Electrical Stimulation. Rehabilitation was carried out in selected Physiotherapy departments three times a week for twelve weeks. Statistics of mean, standard deviation and frequency of occurrence were used to describe the data. Inferential statistics of correlation t-test was analysis between pretest and post-test in each group revealed that therapeutic exercises has a significantly positive effect on the range of motion in the affect angle joint. Lastly, Analysis of Variance (ANOVA) used in analyzing the difference among the three groups revealed the therapeutic exercise was more effective than electrical stimulator in the management of SNII. But the effect was multiplied among group where the two modalities were combined.

Keywords: Therapeutic, Sciatic nerve, Stimulation, Physiotherapy, Rehabilitation

Introduction

Unsafe injection practices are estimated to have significant impact on patient morbidity and mortality. Unsafe injection practice results in millions of dollars in direct mechanical cost on an annual basis (WHO, 1999).

Justification and site selection is critically important because the medication effect can be enhanced or diminished depending on the site of injection and complication like muscle contracture and nerve injury are site dependent. Therefore, vaccines are advised not to be administered in gluteal area even in children (Bergeson, Singer & Kaplan, 1982).

However, lower-extremity nerve injuries are commonly seen in this part on the world, lesions involving the sciatic nerve comprised the largest, about 60% of the injury is usually due to injection. This is said to be the common injury mechanism affecting the sciatic nerve at the buttocks (Kline, Kim, Madha, Haesh & Robert, 1998). Frequent presentations after injury include **radicular pain** and **paraesthesia** with motor and sensory **deficit**.

According to Natarajan (2005) the common complication that usually arises from this condition and which can cause permanent disability in the patient if neglected is commonly referred to as **foot drop**, otherwise known as **Injection Nerve Palsy**. On examination the patient will be unable to dorsiflex the ankle which will reduce the range of motion (ROM) and will not be able to extend the toes due to paralysis of the foot extensors. The patient will also be unable to evert the foot due to paralysis of the peroneal muscles. There will be loss of sensation in the outer aspect of the leg and dorsum of the foot.

Pollock and Wilmore (1984) opined that the more active an individual is, the more flexible he is, however the activity must be performed through the full range of **motion**. Hamzat (1998) argued that any physical exercise programme aimed at improving the muscular strength is invariably enhancing the neuromuscular aspect of the participant's system. According to Low and Reed, (1994) the motion may be limited by different tissues and from different causes, they argued that electrical stimulation of fibrous tissues are scarring. Limitation of joint motion due to shortening of soft tissues on one side of the joint can be treated by cyclical electrical stimulation of the muscle that stretch the contracture.

The interest of this research is to determine the effect of exercise (EXS) and electrical nerve stimulation (ENS) in the management of this condition. Likewise, whether exercise combined with electrical stimulation of the muscles affected will improve the range of motion at the affected point. Therefore, this study is interested to see if ENS with isometric exercise is as effective as, or more effective than isometric exercise alone in increasing the range of motion at the ankle joint of children age 3 to 10 years.

The following four null hypotheses were tested:

1. There will be no significant difference between the pre-test and post-test ankle range of motion in injection nerve injury patient who received 12 weeks of resistant exercise treatment.
2. There will no significant difference between the pre-test and post-test range of motion of injection nerve injury patient who received 12 weeks of ENS treatment.

3. There will be no significant difference between the pre-test and post-test ankle range of motion of injection nerve injury patient who received 12 weeks of combined resistant exercise E.S treatment.
4. There will be no significant difference between the pre-test and post-test ankle range of motion in injection nerve injury patient in the three treatment groups.

Materials and Methods

Participants

Thirty participants were selected using purposive sampling method in which sample selection was based on inclusion criteria. The criteria were that patients had been diagnosed with sciatic nerve injury secondary to injection. The participants were within ages 3 to 8years. Systematic random sampling technique was adopted in which selection was at fixed interval to group the 30 participants into the three treatment groups.

Instrumentation

The following instruments were used to collect data

(a) Physiotherapy case note: Information on age, sex, onset and duration of condition for the participating individuals with SNI was recorded from their case note or taken directly from the parent or guardian

(b) Goniometer: Standardized goniometer which consist of protractor, a fixed arm and a moveable arm for taking range of motion (flexibility) in degree of angle to know the range of motion in the ankle joint

(c) A modified sphygmomanometer: A self modified sphygmomanometer consisting of an arm cuff was used in quantifying the strength of the dorsiflexors and the plantarflexors of the ankle joint. Modified sphygmomanometer has been shown as in instrument to objectively assess muscle strength by Helewal *et al.* (1981) and Cheryl Giles (1984)

(d) Electrical nerve stimulator (Endo-med 581 Enra-Nonius Box 810, 2600 AV DELFT Netherlands)

(e) A Plinth and

(f) 0.2-1kg sand bags as resistance load

Procedure

The purpose of the study was duly explained to the participants parent or guardian after which informed consent form was given them to sign.

1. Age, date of onset and gender was taken.
2. The participants were made to remove socks, tight wears and sandals which can disturb the rate of flow of blood or produce additional resistance.
3. In supine position, the range of motion (flexibility) of the affected limb was taken with gravity eliminated
4. In high sitting on the plinth 10 repetitions maximum is determined, alternative ankle flexion and extension with 0.2kg sand bag was attached to the anterior part of the foot. This is done for 15 minutes, number of repetition done were counted and recorded. Progressive resistant training programme was adopted.

Table 1: Muscles used to localize sciatic nerve lesion

Muscle innervated	Action	Nerve	Site of origin	Nerve roots
Short head of biceps femurs	Knee flexion ankle dorsiflexion	Sciatic Peroneal branch	Mid thigh Upper leg	L5, S1, L4, L5
Tibialis anterior	Foot eversion	Deep personal	Mid leg	L5, S1
Posterior tibial	Foot inversion	Posterior tibial	Upper leg	L5, S1

The participants were randomly assigned into three different treatment groups:

Group 1: This consisted of 10 participants with sciatic nerve injury who were treated with exercise only.

Group 2: This consisted of 10 participants with sciatic nerve injury who were treated with Electrical Nerve Stimulator (ENS).

Group 3: This group is made of 10 participants in number and they were treated with both exercise and electrical nerve stimulator.

The pre-test scores obtained from range of motion using goniometer for patients in the 3 groups were recorded. The treatment lasted for 12 weeks after which the last measurement was taken as the post-test score.

Statistical Analyses

The descriptive statistics of means value and standard deviation for all scores and demographic variable were determined. Correlated paired samples t-test was used to compare pre-test and post-test differences in each group. Analysis of variance (ANOVA) was used to compared differences among the three treatment groups. The level of significance was set at 0.05 for each hypothesis.

Results

The tables below show the frequency and percentage of the sex and physical characteristics of participants in the three treatment groups.

Table 2: Sex and Physical Characteristics of Participants in the Three Treatment Groups

Treatment group	Male	Female	Age	Weight	Height
Exercise only (I)	7	3	4.8±1.7	18.33±3.89	1.12±.13
ENS only (II)	6	4	4.8±1.6	15.26±3.65	1.15±.09
Exercise + ENS (III)	4	6	4.6±1.7	15.31±3.5	1.09±.11

Table 2 above shows the number of male and female participants assigned into each of the three groups; also the mean and standard deviation of the age and physical characteristics of all the participants.

Table 3: Effect of Therapeutic Exercises on Ankle Range of Motion

	Mean	SD	N	t-cal	Df	P
Pre-test	4.90	5.53				
Post-test	28.30	11.84	10	5.09	9	0.0

t-critical = 2.262
t-calculation > t-critical

Table 3 indicates that all the 10 participants completed the exercise treatment with mean pre-test ankle range of motion of 4.90mm and post-test of 28.30mm. The mean paired differences was 23.60 while calculated t-value of 5.09 is higher than the critical t-value of 2.62 at $P<0.05$. The treatment impact was therefore found to be significant.

Table 4: Effect of Electrical Nerve Stimulation on the Ankle Range of Motion

	Mean	SD	N	t-cal	Df	P
Pre-test	1.00	3.16				
Post-test	15.99	3.27	10	3.21	9	0.01

t-critical = 2.262
t-calculation > t-critical

In assessing the effect of electrical nerve stimulation in the ankle range of motion, table 4 shows the mean pre-test value of 1.00mm and the post-test mean value of 15.99. the mean difference is 14.99 while calculated t-value of 3.21 is higher than the critical t-value of 2.262 and significant P-value of 0.01 is below the alpha level set at 0.05 (P< .05), therefore there is a significant difference between pre-test and post-test ankle range of motion of injection nerve patients who received electrical nerve stimulation treatment.

Table 5: Effect of Combination of Therapeutic Exercises and ENS on Ankle Range of Motion

	Mean	SD	N	t-cal	Df	P
Pre-test	2.50	6.24				
Post-test	32.3	12.7	10	6.43	9	0.0

t-critical = 2.262
t-calculation > t-critical

Table 5 shows the effect of combination of therapeutic exercise and electrical stimulation on ankle flexibility. The pre-test mean value is 2.50mm while the post-test value is 32.3mm. the calculated t is 6.43 while the t-critical is 2.262. therefore, the effect of the combined treatment is significant at P<0.05.

Table 6: Mean difference between pre-test and post-test Ankle Range of motion

Group	Mean Pretest mm	SD	Mean posttest mm	SD	Difference between Pre -test & post-test mm
EXS	4.90	5.53	28.30	11.84	23.4
ENS	1.00	2.16	15.90	14.29	14.9
EXS+ENs	2.50	6.24	32.30	12.74	29.80

Table 6 above shows the mean difference between pre test and post test of exercise (EXS) group to be 23.4mm; for ENS group it is 14.9 while for EXS + ENS it is 29.80.

Table 7: Analysis of Differences in pre-test post-test changes in range motion (flexibility) in all the treatment groups

	Sum of Square	Mean of Square	f-ratio	Sig. (P)
Range of motion	1549.79	774.90	4.51	0.02

Df (numerator) = 2
Df (denomintator) = 27
f-critical = 3.35

Table 7 shows the analyses of the difference in pre-test – post-test changes in ankle flexibility among three treatment groups. The table reveals a calculated F-value of 4.51. This is significantly at $P<0.05$ at degree of freedom of 2 numerator and 27 denominator, the f-critical is 3.35.

Discussion

In this study it was discovered that exercise, ENS and the combination of the 2 modalities have significant positive effect on the range of motion (flexibility). The treatment modalities employed in this study include therapeutic exercise in form of passive movement, massage, free active exercises and resisted exercises. The second treatment modalities involve electrical nerve stimulation and the third, combination of the two-treatment procedure. The result revealed a significant difference between the pre-test and post-test range of motion in all the treatment groups. The pre-test post-test changes when analysed using correlated sample t-test and analysis of variance (ANOVA) with alpha level set at 0.05 the four hypotheses were rejected. Likewise the mean difference from the three groups as shown on table 6 confirms these findings. This result is in line Bischoff and Rose (2030), who recommended both aerobic and strengthening exercise to reduce pain and function disability on range of motion or flexibility. Similarly, Carinick (1996) also recommended that electrical nerve stimulating be used as an adjunct to physical therapy to increase strength, range of motion (ROM) motor control and coordination and to reduce temporarily sparsticity.

Conclusion

It was inferred from this study that the condition is more common in male than female which confirmed the work done by Prichett and Porembski (2005). The study concluded that injection nerve injury patients who were given any of these treatment (exercise, ENS or combination of the two modalities) will have improvement on joint flexibility. The implication of this study is that for management of sciatic nerve injury joint flexibility improvement will be observed when treated with ENS but improve better where exercise is used. However, there will be a tremendous significant improvement if the two treatment modalities were combined.

References

Bergeson, P.S, Singer S.A., Kaplan A. M. (1982). *IM Injection in Children, Pediatrics;* 70: 944-948.

Carnick J. (1997). Use of neuromuscular electrical stimulation and a dorsal wrist splint to improve the hand function of a child with spastic hemiparesis. Physical Therapy (6).

Cheryl, .G. (1984). Case Report: the modified sphygmomanometer: an instrument to objectively assess muscle strength. *Physiotherapy Canada* 36 (1).

John, L. & Ann, R. (1994) Electrotherapy explained: Principles and Practice, (1) 95-105.

Hamzat, T.K. (1998). Beneficial effects of exercise on nervous and musculoskeletal systems. *Physioray* 2 (1) 41-42.

Hellwal. G.H., Goldsmiths and Smythert H.A. (1980): The modified sphygmomanometer – An Instrument to measure muscle strength, A validation Study. *Physical Therapy.*

Kline, D. Daniel, K., Rajiu M., Carter H., and Robert, T. (1998). Management and Results of Sciatic nerve injuries: A 24 year experience. *Journal of Neurosurg*: 89; 13-23.

Natarajan M. (2005): Nerve injuries in M. Natarajan & N. Mayilvahanan (Ed) *Book of Orthopedic and Tranmatology* M.N. Orthopedic Hospital chapter 26.

Pollock, M.L. Wilmore, J.H. and Fox III S.M. (1984): *Exercise in Health and Disease Evaluations and Prescription for prevention and rehabilitation* Philadephia, W.B. Saunders Company.

Printchatt J.W. and Porembski, M.A. (2005): Foot drop Arch. Phys Med. Rehabil.

WHO (1999) Safety of Injections: A brief background. WHO, Geneva, *Fact Sheet* (231).

WHO (1999) Unsafe injection practice and transmission of blood borne pathogens. *WHO Bulletin* 1999; 77: 787-797.