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Original article :

Clinical outcome of inclusion of ergonomic education in management of Sciatica among Male Bus drivers –a comparative study between conventional physical therapy for sciatica with that of the Back school type of ergonomic education in addition to physical therapy

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Abstract

Background: Sciatica due to intervertebral disc prolapse is reported frequently among bus drivers due to working condition, work pattern and work related factors, like long driving hours and assume improper posture during driving. In this study efficacy of inclusion Back school type of Ergonomic education along with physical therapy was compared with efficacy of physical therapy alone, in the management of sciatica among bus drivers. Ergonomic education for sciatica in the form of Back school [aim] at creating awareness about factors leading to sciatica ,as well as anatomy and patho-mechanics related to sciatica .

Materials and Methods: A prospective cohort interventional study comparing 128 Bus drivers clinically diagnosed with Sciatica Low back pain[4,5] was conducted in Department of Physical Medicine and Rehabilitation Government Kilpauk Medical College, Chennai, Tamilnadu, India. Duration of the study-12 months July 2020 to June 2021 The 128 subjects were allocated in to two groups ,64 subjects of group A received Physical Therapy, TENS along with Mc kenzie exercise programme while another 64 subjects of group B received Back school model of Ergonomic education for managing Sciatica in addition to TENS along with Mc kenzie

Results: Demographic data -In this study **age wise t**he number of subjects below 30 years in group A were 24(37.50%) where as in group B were 26(40.63%) .In the age range between31 to 40 years 26 subjects(40.63%) were in group A and 20 subjects (31.25%) were in Group B. The number of subjects within age range between 41 to 50 years in Groups A was 14(21.87%) and Group B were 18(28.12%). Regarding values of Body Mass Index 14.06% and 18.75% of subjects were underweight, 25.56% and 15.62% were overweight in Group A and Group B respectively.18.75% in Group A and 17.81% in Group B were obese. In Group A-25.00 % and in Group B-32.81% of subjects were smoking tobacco .The habitual consumption of alcohol was self reported in 35.94 % of Group A and 42.19% of Group B.

Conclusion– In this study among the Bus drivers suffering with sciatica, there was statistically significant improvement in pain relief, evident with Post session VAS pain score, and in terms of ODI score, the disease specific functional disability scale in subjects of both Group A with Physical-Therapy alone as well as group B with Back school type of ergonomic education in addition to Physiotherapy protocol.

Key words– Sciatica , TENS-Trans cutaneous Electrical Nerve Stimulation,Mc Kenzies Exercise

Introduction

Sciatica[1,2,3] due to prolapsed intervertabral disc is common cause low back pain radiating to lower limb. Bus driving[4,5,6] is one of the occupation where people complaints of Sciatica[123] due to working condition, work pattern and work related factors, like long driving hours and assuming awkward lumbar spine posture during driving. Reports reveal Mc

kenzies[11,12,13,14] exercise and Physical modality such as TENS(Transcutaneuoselectrical Nerve Stimulation) help to partially alleviate symptoms of sciatica. Back school type of Ergonomic education for sciatica Create awareness on Anatomy and Pathomechanics related to Sciatica as well as Ergonomic risk factors and work pattern related to sciatica. Indeed this type of ergonomic education emphasize on Spinal Posture Correction by Ergonomic Positioning[25,26],work pattern to avoid continuous prolonged sitting hours to prevent spinal extensors exhaustion there by averting habitual Lumbar Kyphosis. Back school also emphasize Ergonomic correction of driver settings by adjusting and modifying driver seat[28,29]height, seat base of support and adequate Back rest and inclination of Back rest[30,31] (around 100 degrees to Horizontal Plane). by modifying steering wheel[27] reach distance and height from the trunk of the body to avoid slouching as well as over reach. In this study efficacy of Ergonomic education together with physical therapy was compared with efficacy of physiotherapy alone, in the management of sciatica among male bus drivers.

AIM –to compare the clinical outcome of inclusion of Back school[7,8,9,10] model of ergonomic education with that of conventional physical-therapy alone of in management sciatica among Bus Drivers

STUDY DESIGN: A Prospective cohort Interventional Study

SOURCE OF DATA: Bus drivers with Sciatica who sought pain management at Department of Physical Medicine and Rehabilitation Government Kilpauk Medical College, Chennai, Tamilnadu, India

STUDY POPULATION: Male Bus drivers with sciatica for more than 3 weeks

Study Duration -12 months July 2020 to June 2021

SAMPLE SIZE: 128 (Group A-consisted of 64 subjects receiving Physio care alone with TENS and Mc kenzie exercise programme along with TENS while another 64 subjects of group B received Back school type of ergonomic education along with TENS and Mc kenzie exercise programme .

Sampling: Convenient sample

Inclusion criteria:

- ✓ Males Bus Drivers diagnosed with Sciatica (with Straight leg rising test positive below 70 digress of hip flexion with concomitant extension of knee done by passive lifting of lower limb).
- ✓ Age group between 18 to 50 years of age
- ✓ who were driving at least more than 3 years of Driving
- ✓ who drive at least more than 6 hour per day

Exclusion Criteria:

- ➢ Low back pain due to any, trauma or surgeries.
- ➢ organic low back pain due to other conditions like vertebral fractures, inflammatory cause, neoplastic cause ,back pain due to infective cause
- ➢ Low back pain with red flags motor weakness, bladder or bowel neurogenic dysfunction

Outcome Measures

- ➢ **Visual Analogue Scale[15,16,17](VAS) for Pain is a s**traight horizontal line of fixed length, usually 100-mm The patient express his severity of perceived pain by marking corresponding distance on this horizontal straight line . VAS score less than 5 mm may be interpreted as no pain, 100-mm VAS scores from 5 to 44 mm may be graded as mild pain, 100-mm VAS scores from 45 to 74 mm may be taken as moderate pain, and 100-mm VAS scores 75 mm and greater may be interpreted as severe pain.
- ➢ **Oswestry Disability Index[18,19,20,21](ODI)** -The ODI assess ability of ten disease specific functions as follows pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life and travelling. The ODI was chosen

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disease specific functional disability measure and (0 to 100 %) as its context encompass most of Comprehensive ICF[22,23,24] Core sets for Low Back Pain that inclusive of Sciatica.

- **Methodology**

128 (64 Subjects each in Group A and Group B) Bus drivers with sciatica who sought treatment at Department of Physical Medicine and Rehabilitation Government Kilpauk Medical College, Chennai, Tamil nadu, India, were clinically diagnosed with Sciatica based on the diagnostic criteria (excluding specific cause of Sciatica due to other organic causes as well as due to trauma) were recruited in the study.

Intervention-

Group A- received .Physio-care[16]

- ✓ TENS 28 sessions x15 minutes each on consecutive Days
- ✓ Mckenzie Exercise Prgramme[17,18] for 28 sessions x 30 minutes each on consecutive Days.

Group B received Ergonomic Education[7,8,9,10] for Sciatica in addition to Physio Care[16]

- ✓ Back School[7,8,9,10] type of Patient Education for Sciatica 28 sessions x30 minutes each
- ✓ TENS -28 sessions X15 minutes each on consecutive days
- ✓ Mckenzie Exercise Prgramme[17,18] for 28 sessions x 30 minutes each on consecutive Days.

Group A- Physio Care[16 alone]	**Group B-** Ergonomic Education[7,8,9,10] +Physio Care[16]
	✓ Back School ergonomics education 28 sessions x 30 minutes each on consecutive Days
✓ TENS 28 sessions x15 minutes each on consecutive Days	✓ TENS 28 sessions x 15 minutes each on consecutive Days
✓ Mckenzie Exercise Prgramme[17,18] for 28 sessions x 30 minutes each on consecutive Days	✓ Mckenzie Exercise Prgramme[17,18] for 28 sessions x 30 minutes each on consecutive Days

Demographic details such as age, BMI and personal habits, were collected .Pre-session outcome scale at the time of inclusion of subjects in the study and Post session outcome measure were recorded in terms **Visual Analogue Scale[15,16,17] (VAS) for Pain** as well as Disease specific outcome scale for Sciatica the Oswestry Disability Index (ODI) [18,19,20,21].at the time of recruitment of subjects in tothis study and after 4 weeks(28 Days) of recruitment Statistical Analysis was done with SPSS soft ware

Results

-In this study age wise **t**he number of subjects below 30 years in group A were 24(37.50%) where as in group B were 26(40.63%) .In the age range between31 to 40 years 26 subjects(40.63%) were in group A and 20 subjects (31.25%) were in Group B. The number of subjects within age range between 41 to 50 years in Groups A were 14(21.87%) and Group B were 18(28.12%). Regarding values of Body Mass Index 14.06% and 18.75% of subjects were underweight, 25.56% and 15.62% were over weight in Group A and Group B respectively.18.75% in Group A and 17.81% in Group B were obese. In Group A-25.00 % and in Group B-32.81% of subjects were smoking tobacco .The habitual consumption of alcohol was self reported in 35.94 % of Group A and 42.19% of Group B.

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Table [1]

Demographic Data of Group A and group B					
		Group-A- Physio Care alone (TENS+ McKenzies Excercise)		**Group-B (Back-school ergonomics Education +TENS,McKenziesExcercise)**	
		Group A No of patients	**Percentage**	**Group B No of patients**	**Percentage**
Age group	<30	24	37.50	26	40.63
	31-40	26	40.63	20	31.25
	41-50	14	21.87	18	28.12
BMI	Underweight	9	14.06	12	18.75
	Normal weight	26	40.63	31	48.44
	Overweight	17	26.56	10	15.62
	Obese	12	18.75	11	17.19
Smoking	Yes	16	25	21	32.81
	No	48	75	43	61.19
Alcohol	Yes	23	35.94	27	42.19
	No	41	64.06	37	57.81

Outcome Scale Scores

1.Descriptive Analysis of Pre and Post session VAS scores(Pain Scale) in Sciatica

a).Descriptive Analysis of Pre and Post Physio care session VAS scores in **Sciatica** (in Group A)

Visual analogue pain scale values within in group A showed that, *Physio- Post session VAS score score* (M = 24.1, SD = 11.72). had lower values than the *Physio pre session VAS score* (M = 60.09, SD = 18.21).

b).Descriptive Analysis of Pre and Post Back School session VAS scores in **Sciatica,** (in Group B)

In Group B The *Back School Post session VAS score* (M = 22.17, SD = 11.04) had lower values than the *Back- School Pre session VAS score* (M = 62.09, SD = 18.14).

c).The Difference in the mean Pre and post session VAS score (outcome scale for Pain) was greater in Group B (38.27) when compared to group A (33.78)

Table [2]. Descriptive Statistics of Pre session and post session VAS scores of both Group A and Group B

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	Physio pre VAS score	Physi- Post VAS score	Back- School Pre VAS score	Back School Post VAS score
Minimum	18	6	22	3
Maximum	87	56	89	55
95% Confidence interval for mean	55.54 - 64.64	21.17 - 27.02	57.56 - 66.62	19.41 - 24.93
Mean ± Std.	60.09 ± 18.21	24.1 ± 11.72	62.09 ± 18.14	22.17 ± 11.04

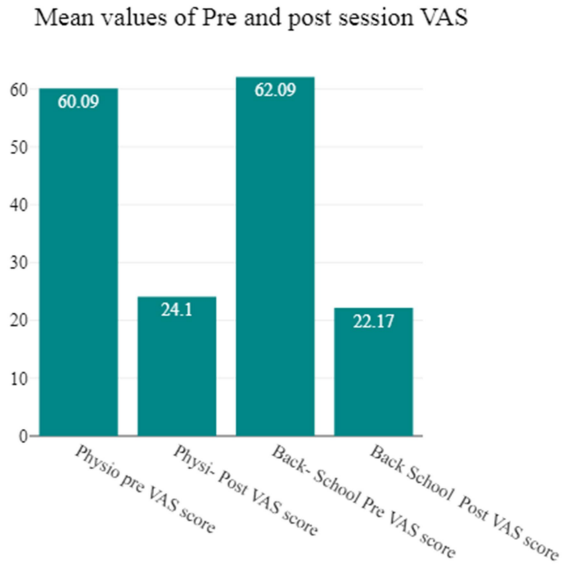

Figure 1--Pre and post session VAS scores of Group A and Group B

2.Descriptive Analysis of Pre and Post session ODI scores(Functional Scale for Sciatica

a).Descriptive statistics- *of Physio Care Pre session ODI and Physio care Post session ODI*

Disease specific disability Outcome scale for Low back pain in terms of ODI score showed in Group A, *Physio care-Post session ODI* (M = 29.81, SD = 12.02). had lower values than the the *Physio Care Pre session ODI* (M = 60.22, SD = 18.38)

	n	Mean	Std. Deviation	Std. Error Mean
Physio Care Pre session ODI	64	60.22	18.38	2.3
Physio care Post session ODI	64	29.81	12.02	1.5

b).Descriptive statistics- *of* Back school *Pre session ODI and* Back school *Post session ODI*

within Group B the *Back school Post session -ODI* group (M = 23.89, SD = 12.33)had lower values than the *Back school Pre session ODI* group (M = 59.88, SD = 19.38).)

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	n	Mean	Std. Deviation	Std. Error Mean
Back school Pre session ODI	64	59.88	19.38	2.42
Back school Post session -ODI	64	23.89	12.33	1.54

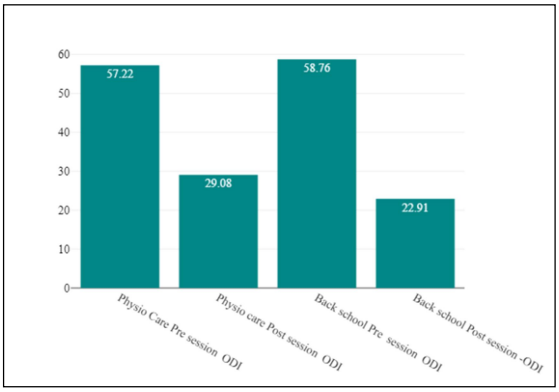

Figure 2,Pre and Post Owstery Disability Index ODI Scores in Group A and Group B

c).Descriptive statistics Physio care Post session ODI and Back school Post session –ODI

The results of the descriptive statistics showed that *Back school Post session -ODI* (group B (*M* = 23.89, *SD* = 12.33).had lower values for the dependent variable than the the *Physio care Post session ODI* (Group A) (*M* = 29.81, *SD* = 12.02)

	n	Mean	Std. Deviation	Std. Error Mean
Physio care Post session ODI	64	29.81	12.02	1.5
Back school Post session -ODI	64	23.89	12.33	1.54

Statistical analysis:

The collected data was **Statistically analysed** applying Microsoft Excel. ,based on which graphs and tables were obtained. along with the demographic data of both interventional group and pre as wel as post interventional scores of ODI score as disease specific functional scale and VAS score as pain scale were used as a measurement tool to evaluate the efficacy of Back school patient education program with perspective of ergonomic kinematic correction ..A two tailed t-test for independent samples and showed that the statistically significant difference between for *Physio-care Post session ODI* scores (from Group A) and *Back school Post session-ODI* scores(from Group B) with respect to the dependent variable was, $t(126) = 2.75$, $p = .007$, 95% confidence interval [1.65, 10.19]. The effect size d was 0.49 (equal variances assumed).

a).Statistical Analysis of Physio Care Pre session ODI scores and Physio care Post session ODI scores

Paired t-test for paired samples within in Group A (*Physio Care with McKenzie Exercise Pre session ODI score and Post session ODI score*s) showed that this difference was statistically significant, $t(63) = 16.9$, $p = <.001$, 95% Confidence interval [26.81, 34].

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t-Test for paired samples

	t	df	p	Cohen's d
Physio Care Pre session ODI - Physio care Post session ODI	16.9	63	<.001	2.11

95% Confidence Interval of the Difference

	Mean	Std. Deviation	Std. Error Mean	Lower limit	Upper limit
Physio Care Pre session ODI - Physio care Post session ODI	30.41	14.4	1.8	26.81	34

b).Statistical Analysis of Back school Pre session ODI scpresand Back school Post session –ODI scores

Paired t-test for paired samples within group B (*Back school programme with McKenzies Excercise Pre session ODI scores and Post session–ODI scores*) showed that this difference was statistically significant, $t(63) = 14.29$, $p = <.001$, 95% Confidence interval [30.95, 41.02].

t-Test for paired samples

	t	df	p	Cohen's d
Back school Pre session ODI - Back school Post session -ODI	14.29	63	<.001	1.79

95% Confidence Interval of the Difference

	Mean	Std. Deviation	Std. Error Mean	Lower limit	Upper limit
Back school Pre session ODI - Back school Post session -ODI	35.98	20.15	2.52	30.95	41.02

c).Statistical Analysis of Physio care Post session ODI and Back school Post session –ODI

A two tailed t-test for independent samples (equal variances assumed) . showed that the statistically significant difference between for *Physio-care Post session ODI* scores (from Group A) and *Back school Post session-ODI* scores(from Group B) with respect to the dependent variable was, $t(126) = 2.75$, $p = .007$, 95% confidence interval [1.65, 10.19]. The effect size d was 0.49 (equal variances assumed)

t-Test for independent samples

	t	df	p	Cohen's d
Equal variances	2.75	126	.007	0.49
Unequal variances	2.75	125.92	.007	0.49

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95% Confidence Interval of the Difference

	Mean Difference	Standard Error of Difference	Lower limit	Upper limit
Equal variances	5.92	2.15	1.65	10.19
Unequal variances	5.92	2.15	1.65	10.19

Based on paired t test with samples within same group in Both Group A (Physio care)and Group B(Back School) there wasstatistically significant improvement between the pre as post session VAS and ODI for functional outcome,

However Independent t test showed Group B had better clinical improvement than Group A in primary outcome variables in terms of VAS score for pain relief relief and ODI as functional outcome of **Sciatica**

6. Discussion

Most of the Bus drivers are potential at risk of developing intervertebral disc prolapsed followed by impingement of sciatic nerve resulting in sciatica .Indeed intervertebral disc pressure is highest at sitting posture rather than any other posture. This in turn along with prolonged duration of sitting posture as well as forward reach for steering wheel leading to were the awkward posture, leading to potential risk of intervertebral disc proapse.

Sciatica is related to extreme lumbar Flexion more over prolonged static posture of trunk spine pelvis along with lower limbs,The lack of adequate Back rest ,as well as base of support lead to unaccustomed strain musuloskeletal elements of Lumbosacral segment of spine. Indeed prolonged sitting posture causes deconditioning of core spinal musclesand para-spinal muscles, Prolonged Lumbar flexion to accompolish extreme forward reach for steering in mal fit driving seat leads to in which deactivation of the erector spine musculature with a flexed spine causes stress vertebral body which is transferred to the passive spine structures of the spine, thus increasing risk to strain of ligaments and inter-vertebral discs. Ergonomigaclly poor environment in terms of increased distance between seat and Steering wheel reach as well as height with reference base of support of driver seat lead to awkward forward flexion of Lumbar spine segment,which in turn increase intervertebral disc pressure favouring disc prolapsed followed by sciatica.

Lack of adequate back rest surface area as well as lack of customised inclination of seat back rest out side the range of 100 to 110 degrees an increase the constant strain and lead to fatique of Lumbar segment muscles . Descriptive Analysis of outcome scale for pain and functional disabilty .Visual analogue pain scale values within in group A showed that, *Physio-Post session VAS score score* (M = 24.1, SD = 11.72). had lower values than the *Physio pre session VAS score* (M = 60.09, SD = 18.21).In Group B The *Back School Post session VAS score* (M = 22.17, SD = 11.04) had lower values than the *Back- School Pre session VAS score* (M = 62.09, SD = 18.14). Disease specific disability Outcome scale for Low back pain in terms of ODI score showed in Group A, *Physio care-Post session ODI* (M = 29.81, SD = 12.02). had lower values than the the *Physio Care Pre session ODI* (M = 60.22, SD = 18.38),Correspondingly the *Back school Post session -ODI* group (M = 23.89, SD = 12.33)had lower values than the *Back school Pre session ODI* group (M = 59.88, SD = 19.38). Indeed *Back school Post session -ODI* (group B (M = 23.89, SD = 12.33).had lower values for the dependent variable than the the *Physio care Post session ODI* (Group A) (M = 29.81, SD = 12.02)

Conclusion–

The observed outcome scales pre and post session VAS and ODI in this study population among Bus drivers suffering with sciatica at Chennai, concluded that moderate to severe impaired functional disability occurred a consequence of sciatica, due to various ergonomic factors involved while driving the Bus.

In this study, there was statistically significant improvement in pain relief, evident with Post session VAS pain score, and in terms of ODI score, the disease specific functional disability scale in subjects of both groups, Group A with

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Physical-Therapy alone as well as group B with Back school type of ergonomic education in addition to Physiotherapy protocol.

However improvement in post session outcome parameters VAS as well as ODI in Group B managed with add on Back school ergonomic education is better than that of the group A managed with Physical Therapy alone as evident with statistically significant difference proved with two tailed Independent t test for *Post Physio session ODI* scores and *Post-Back School session ODI* scores.

Hence the observations in this study emphasise the requirement of programmed ergonomic education in order to create self awareness of anatomical , patho-mechanical factors as well as ergonomic risk Factors leading to Sciatica with self motivated practice of strategies to reduce severity of pain as well as to prevent recurrence of Sciatica among the Bus drivers who are at potential risk of suffering with sciatica **.**

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