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SPINAL MOBILITY IN GRADUATED PHYSIOTHERAPIST

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ABSTRACT

Background: The nature of the work in a physiotherapy practice is physically demanding, and it involves repetitive tasks, high-force manual techniques for treating patients, techniques that exert direct pressure on certain joints during treatment, awkward positioning of joints during certain maneuvers and prolonged constrained postures. These physical factors expose physiotherapists to various work-related musculoskeletal injuries. The incidence of WRMDs among physiotherapists was highest in low back, neck, shoulders and upper back. **Objective:** The study was carried out to assess Spinal Range of Motion using inch tape for cervical spine and lumbar spine, to compare the acquired data with the normative data of spinal range of motion for cervical and lumbar spine and to find out the incidence of deviation in spinal ranges from the normal for cervical and lumbar spine if any and to compare the deviations if any with the number of working hours, years of experience and posture attained for maximum time, if any. **Materials and Methods:** A study was carried out with 80 participants that included postgraduate students and staffs of Dr. D.Y. Patil College of Physiotherapy, the data collected was analyzed using graphs and tables and presented in a tabular format. **Results and Conclusion**: The study concluded that there are deviations in spinal range of motion of graduated physiotherapist due to nature of work, hours and years of work. Study shows that lumbar flexion range is maximally affected and maximum physiotherapist reported back pain amongst the musculoskeletal disorders.

KEYWORDS: Spinal mobility, cervico-lumbar range of motion, inch tape.

INTRODUCTION

The vertebral column consist of 33 vertebrae and 23 inter vertebral disc, it is divided into five regions.

a. Cervical (C1-C7)
b. Thoracic (T1- T12)
c. Lumbar (L1-L5)
d. Sacral (S1-S5 fused)
e. Coccygeal (C1-C4 fused)

In the column of an adult four distinct antero- posterior curves are evident. The two curves (thoracic and sacral) that retain the original posterior convexity throughout life are known as primary curves, where as the two curves (cervical and lumbar) that show the reversal of origin that show posterior convexity are called secondary curves.[1] Curves that have posterior convexity (anterior concavity) are kyphotic curves, curves that have an anterior convexity (posterior concavity) are lordotic curves.[1]

1. Cervical

The cervical spine is a remarkably complex segment, as it not only supports the mass of the head but also allows the widest range of motion relative to the rest of the spine.[2]

Morphologically and functionally, the cervical column is divided into two distinct regions: the upper cervical spine and the lower cervical spine. The upper cervical spine includes the occipital condyles and the first two cervical vertebrae, C1 and C2 .The lower cervical spine includes the vertebrae of C3 to C7.[1]

The load distribution of the cervical spine is primarily in the posterior columns, with 36% in the anterior column and 64% in the 2 posterior columns.[2]

Movements occurring in cervical spine and their tape measurements are[3]

Table-1.

Movements	Normal ROM
Flexion	1.0-4.3 cm
Extension	18.5-22.4 cm
Side flexion	10.7-12.9 cm
Rotation	11.0-13.2 cm

2. Lumbar

The 5 lumbar vertebrae are distinguished by their large size and their absence of costal facets and large foramen. The first four lumbar vertebrae are similar in structure and 5th vertebra has structural adaptation for articlulation with the sacrum.[4]

During flexion and extension of the spine, the lumbar articular processes exhibit bilateral sliding movements in the sagittal plane while the nucleus pulposus undergoes displacement either dorsally or ventrally.[4]

The lumbar vertebral joints appear anatomically designed to facilitate such movements in that their contact surfaces are parallel to the sagittal plane. They allow the mobility which is necessary to accommodate displacements of the nucleus pulposus and at the same time lend lateral stability to the spine. Lateral bending of the spine occurs by means of similar sliding movements in the vertebral joints. On the flexed side each articular process moves into its articular recess.[4]

Movements occurring in lumbar spine and their tape measurements are.[3]

Table-2

Movements	Normal ROM
Forward flexion	6.3cm
Extension	1.6cm

Range of motion measurements often reflect physical impairment or functional mobility in which case external measures of the ROM are more directly applicable.

Ways to assess cervical and lumbar range of motion are- 1) inch tape
2) Goniometer
3) Inclinometer

Inch tape

For cervical spine

Reliability and validity[3]: Research shows that Intratester and intertester reliability coefficients for tape measurements were excellent for cervical lateral flexion (ICCs=0.96 and ICC=0.97, respectively) and for rotation (ICC=0.98 and ICC=0.97, respectively).[3]

For lumbar spine

Reliability and validity[3]: Intratester reliability was excellent (ICC=0.94) and so was interteste rreliability (ICC=0.96). They found that modified Schobers test using a tape measure had the most significant correlations with thoracolumbar changes seen on X-ray.[3]

Research shows that the reliability and validity of tape measurement method is statistically better as compared to inclinometer and goniometer, and hence the assessment with tape measurement method was chosen for this study.

Musculoskeletal disorders (MSDs) can affect the body's muscles, joints, tendons, ligaments and nerves. Most work-related MSDs develop over time and are caused either by the work itself or by the employees' working environment.[5]

Salisk and Ozkan defined WRMDs among physiotherapists as musculoskeletal injuries that result from a work-related event and several studies have documented that work-related musculoskeletal disorders (WRMDs) are frequently experienced by physiotherapists.[5]

Physical therapy can lead to work related musculoskeletal disorders (WRMDs) in Physiotherapist because of nature of their profession. The three most important risk factors that have been associated with WRMDs are repetitive tasks, uncomfortable postures and high force levels.[5]

Sustained and repetitive loading of articular structures may have adverse effects. Damage can occur in one of the two ways: 1) sudden application of large loads and 2) repeated or sustained application of low loads.[1]

The former are non physiological loads that create large stresses and strains, thus creating a rupture of the tissue on microscopic or macroscopic scale (tendon ruptures, bone fractures). The latter are physiological loads that are sustained or repeated while creep is occurring.[1]

Recovery of normal tissue structure takes an unknown time after the load is removed. When a structure is subjected to new loading of already deformed tissue, the tissues may enter the plastic range and undergo microfailure. This may account for some cases of chronic back pain or tendon injuries. Ligaments, or capsule, subjected to constant tensile loading may undergo permanent changes in length.[1]

Joints and their supporting structures subjected to repetitive loading thus may be injured because they do not have enough time to recover before they are subjected to another loading cycle, even though the load magnitude may be within the normal loading range.[1]

The incidence of WRMDs among physiotherapists was highest in low back, neck, shoulders and upper back.[5]

The biomechanical risk factors identified for the development of neck WMSD were heavy physical work, awkward posture, and frequent lifting.

The main risk factors found to have reasonable evidence supporting their causal relationship with neck WMSD were psychosocial factors, smoking, female gender, awkward postures, and co-morbidities.[6]

The main biomechanical risk factors identified for the development of low back work related musculoskeletal disorder were heavy physical work, awkward static and dynamic working postures, and lifting.[6]

The main risk factors found to have reasonable evidence supporting their causal relationship with low back WMSD were heavy physical work, awkward postures, lifting, psychosocial factors, increased BMI and younger age.[6]

The physically demanding nature of physiotherapy itself may contribute to the development of musculoskeletal problems.

Elements of physiotherapy practice which may be considered risk factors include, for example, treatments which demand repetitive movements or continuous bending, twisting and lifting; the tasks, postures and high force levels required for certain manipulations and mobilizations; providing manual resistance; the difficulty in performing safe handling techniques due to a patient's condition and size or shape, particularly where there is a restricted work space; and a work environment made stressful because of an emphasis on high throughput (productivity) and/or understaffing.[7]

Each activity involves the application of relatively high levels of force, and each activity may have to be performed in hazardous postures.[8]

Research has shown that musculoskeletal problems are particularly common in health care workers who are in direct contact with patients. Physiotherapists have a high prevalence of WRMDs. Studies of WRMDs in health care of professionals have identified the lower back as the most commonly involved area of the body, followed by neck and upper extremities.[9]

The lower back has the highest frequency of occupational injury (26%), and wrist-hand (18%), shoulder (14%), and neck (12%) were other sites frequently affected. The factors that most frequently led to WRMD were transferring patients (15%), performing repetitive tasks (14%), and lifting (14%).[9]

Concerning sites of musculoskeletal injury during professional activities, the highest incidence is in the low-back region. Biomechanical studies have shown that physical loading factors, such as body flexion, rotation and weight loading, play a role in this.[9]

According to the literature the work-related activities that most commonly lead to injury in health professionals are lifting heavy equipment and patients, transferring patient, maintaining the same posture for a long period, manual therapy practices, responding to patients' sudden movements, and repeated movements[9] .

Bork identified the main causes of WRMDs in physiotherapists as staying in the same position for along time and continuing to work when tired; Molumphy emphasized lifting and leaning downwards with sudden maximal effort; and West highlighted maintaining the same posture for along time, manual therapy, repeated movements, and increased work load.[12]

Experimental hypothesis: There is difference in ranges of cervical and lumbar spine when compared to number of working hours, years of experience and posture attained for maximum time.

MATERIALS AND METHODOLOGY

To carry out the study initially a synopsis was made and presented and clearance from the ethics committee of college was obtained. Therafter written informed consent was taken from each participant and procedure of study was explained in detail. Subjects were screened as per inclusion and exclusion criteria. Teaching Staff, MPT 1ST year students, MPT 2ND year students were taken as subjects and purpose of the study was explained. After the consent was obtained, range of motion was measured using inch tape for the cervical region and lumbar region.

CERVICAL ROM[3]

Testing position: place the subject in sitting position, with the thoracic and lumbar spine well supported by the back of a chair. Position the head in 0 degrees of rotation and lateral flexion.

a) For cervical flexion and extension.

For flexion: Ask the subject to tuck his or her chin and bend his or her head as far as possible without moving the trunk.[3]

For extension: ask the subject to look straight ahead and then move his or head posteriorly as far as possible, being careful not to extend the trunk.

Measure the distance between the mark on the tip of the chin and mark at the lower edge of the sterna notch at the end of ROM. Make sure that the subject's mouth remains close during the motion.[3]

b) For cervical lateral flexion

Use a skin marking pencil to place marks on the subject's mastoid process and on the lateral tip of the acromial process. Measure the distance between the two marks at the end of cervical lateral flexion ROM.[3]

c) For cervical rotation

Use a skin marking pencil to place mark on the tip of the chin and the acromial process. Have the subject look straight ahead and then turn his or her head to right as far as possible without rotating the trunk. Measure the distance between the two marks at the end of the motion. Have the subject return his head to neutral. Have the subject look straight ahead and then turn his or her head to left as far as possible without rotating the trunk. Measure the distance between the two marks at the end of the motion.[3]

LUMBAR ROM[3]

a) Lumbar flexion and extension

Testing position: place the subject standing, with the cervical, thoracic, and lumbar spine in 0 degrees of lateral flexion and rotation.

Procedure: place the first mark on lumbosacral junction with a skin marking pencil. Place a second mark 10 cm above the first mark. Place a third mark 5cm below the first mark at the lumbosacral junction. align the tape measure between the most superior and the most inferior marks. For flexion- Ask the subject to bend forward as far as possible while keeping the knees straight. For extension- ask the subject to put the hands on the buttocks and to bend backward as far as possible. Maintain the tape measure against the subject's back during the

movement, and note the distance between the most superior and the most inferior marks at the end of ROM. The ROM is difference between 15cm and the length measured at the end of motion.[3]

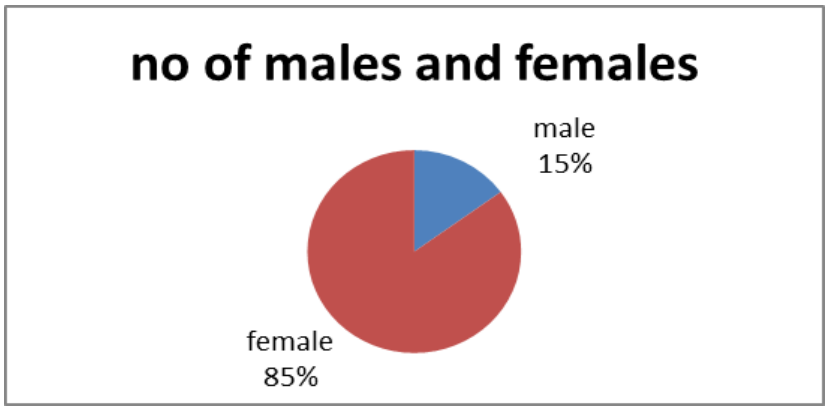
Data measured was collected and data chart was made, also data was analysed to find out if there are any deviations of spinal range of motion in association to number of working hours, years of experience, posture attained for maximum time, if any.

Data was analysed using tables and graphs.

Results

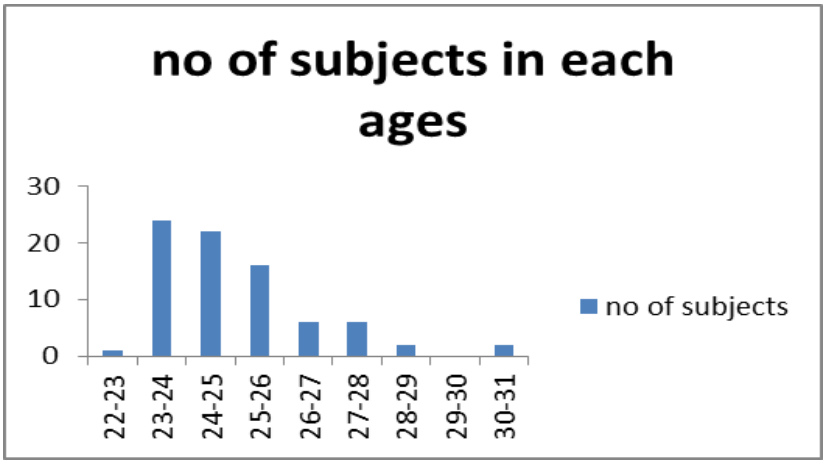
Graph I: Demographic data

a)Gender



Result: Graph I(a): shows that there 85% of females and 15% males i.e number of females were more than the males in the study.

a) Age group



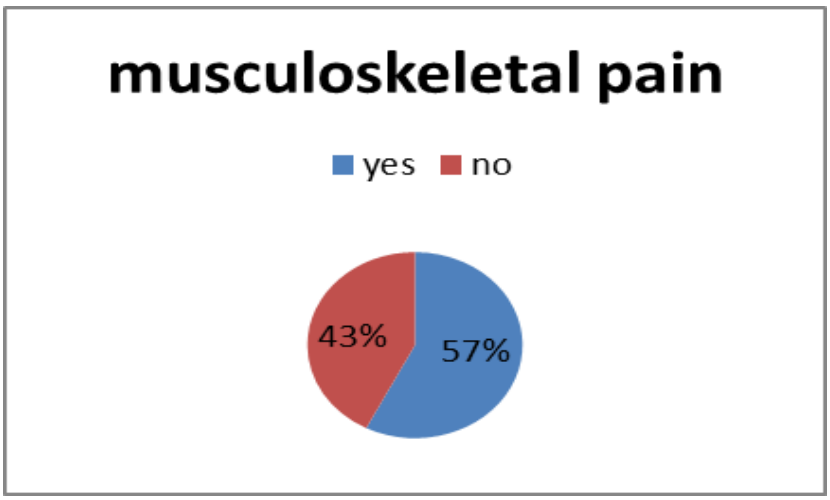
Result: Graph I(b) shows that most of the subjects belonged to 23-24 age group.

Graph II

Musculoskeletal pain

Table II: shows that 36 subjects had musculoskeletal pain and 34 subjects did not have.

Yes	46
No	34



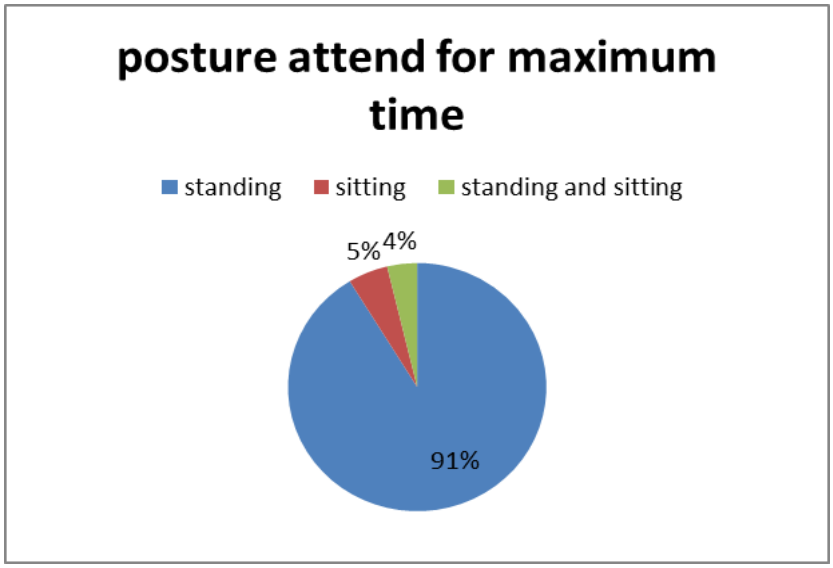
Results: Graph II: Shows that 57% of the people had complain of musculoskeletal pain.

Graph III: Common posture attained by physiotherapist.

Table- III

Table-III shows that 73 subjects used standing posture for maxium time.

Posture	number of people
standing	73
Sitting	4
Standing and sitting	3



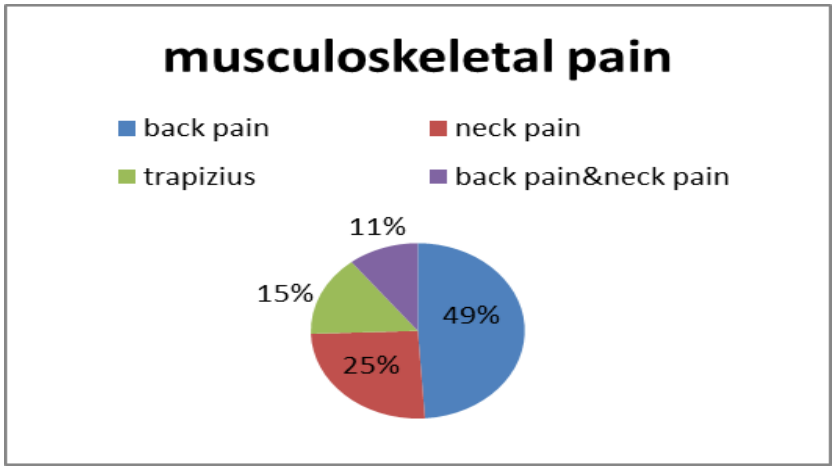
Results: Graph III: Shows that the most common posture attained by physiotherapist while giving treatment is standing.

Graph IV: Type of musculoskeletal pain.

Table-IV

Table IV shows that 23 subjects had back pain, 12 had neck pain, 7 had trapizius and 5 had back pain and neck pain.

Pain	no of persons
back pain	23
neck pain	12
trapizius	7
back pain& neck pain	5



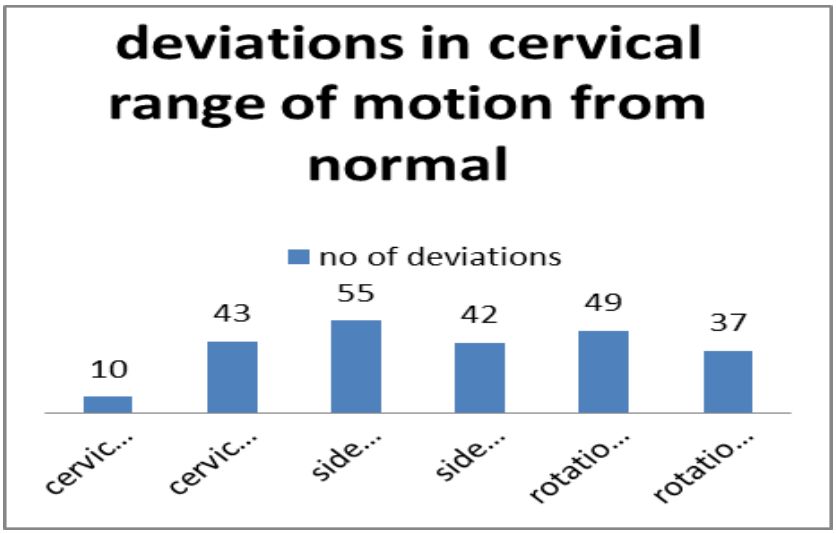
Results: Graph IV: Shows that 49% of subjects had back pain.

Graph V: Deviations in cervical range of motion from normative values.

Table-V

Table V shows that 55 subjects had deviations in cervical range of motiom when compared to normal values.

movements	no of deviations
cervical flexion	10
cervical extension	43
side flexion(rt)	55
side flexion(lt)	42
rotation(rt)	49
rotation(lt)	37



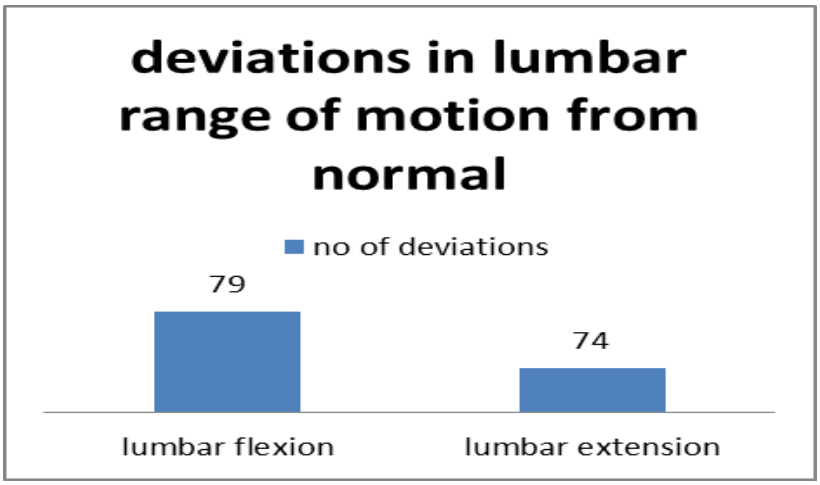
Result: Graph V shows highest deviation in cervical range of motion of side flexion (right) when compared with normative data of cervical range of motion.

Graph VI) Deviations in lumbar range of motion from normative values

Table-VI

Table VI: shows that 79 subjects had deviations in limbar range of motion when compared to normal values.

movements	no of deviations
lumbar flexion	79
lumbar extension	74



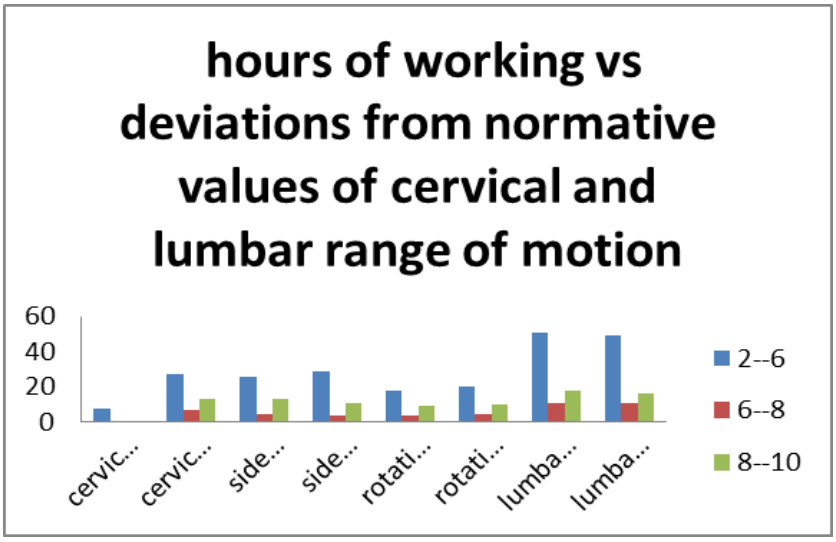
Result: Graph VI shows highest deviation in lumbar flexion range of motion when compared to normative data of lumbar flexion.

Graph VIII: hours of working compared to cervical and lumbar range of motion.

Table-VII

Table VII shows that lumbar flexion was most affected in subjects who worked for 2-6 hours.

hours of working	cervical flexion	cervical extension	side flexion right	side flexion left	Rotation right	Rotation left	lumbar flexion	lumbar extension
2-6	8	27	26	29	18	20	51	49
6-8	0	7	5	4	4	5	11	11
8-10	0	13	13	11	9	10	18	16



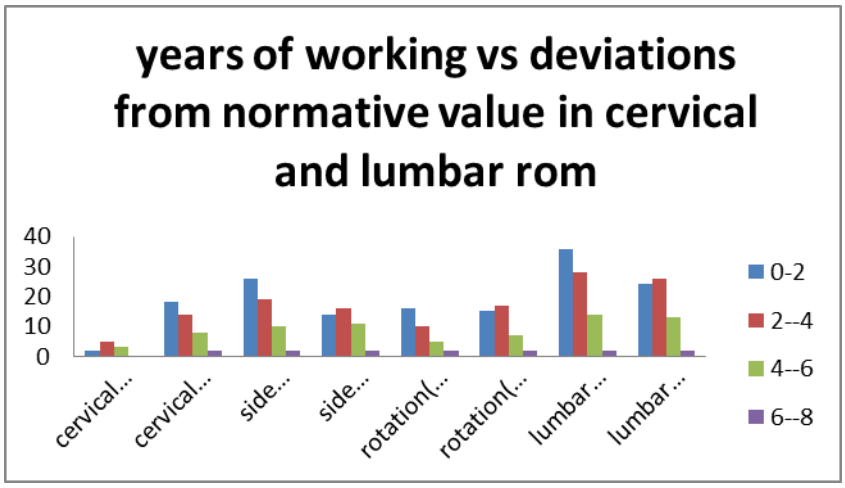
Result: GraphVII shows highest deviation in lumbar range of motion in 2-6 hours of work.

Graph VIII: years of working vs deviations from normative values in cervical and lumar range of motion.

Table-VIII

Table VIII shows that lumbar range of motion was most affected in subjects who had 0-2 years of experience.

years of experience	cervical flexion	cervical extension	side flexion right	side flexion left	Rotation right	Rotation left	lumbar flexion	lumbar extension
0-2	2	18	26	14	16	15	36	24
2—4	5	14	19	16	10	17	28	26
4—6	3	8	10	11	5	7	14	13
6—8	0	2	2	2	2	2	2	2



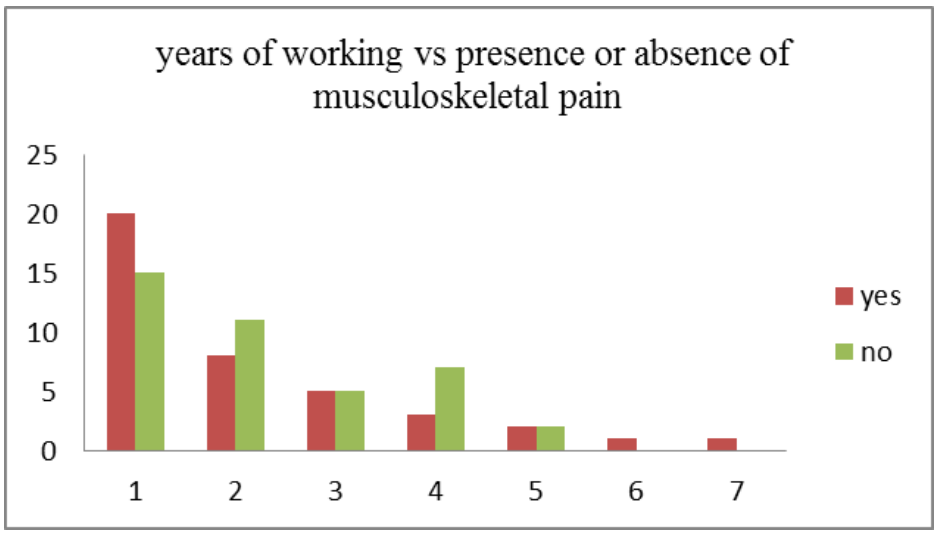
Result: Graph VIII shows highest deviation in lumbar range of motion when compared to years of working.

Graph IX) years of working vs presence or absence of musculoskeletal pain.

Table-IX

Table IX: shows that 23 subjects who had 1 year of work experience had reported musculoskeletal pain.

Sr No	years of working	yes	No
1	1	23	13
2	2	11	7
3	3	5	5
4	4	4	6
5	5	2	2
6	7	1	0
7	8	1	0



Result: Graph IX shows that maximum subjectst that had 1 year of experience had reported highest musculoskeletal pain.

DISCUSSION

Objective of the study was to assess spinal range of motion of cervical and lumbar spine and to find out deviations, if any from nomal values and compare it to hours of working, years of experience and posture attained for maximum time.

Data obtained was analysed and presented in form of graphs and tables.

Table I (a) and graph I(a) shows that there 85% of females and 15% males i. enumber of females were more than the males in the study.

Table I(b) and graph I(b) shows that most of the subjects belonged to 23-24 age group.

Table II and graph II shows that 57% of the people had complain of musculoskeletal pain.

Research has shown that musculoskeletal problems are particularly common in health care workers who are in direct contact with patients. Physiotherapists have a high prevalence of WRMDs. Studies of WRMDs in health care of professionals have identified the lower back as the most commonly involved area of the body, followed by neck and upper extremities.[12] The factors that most frequently led to WRMD were transferring patients (15%), performing repetitive tasks (14%), and lifting (14%).[9]

Table III and graph III shows that the most common posture attained by physiotherapist while giving treatment is standing.

According to the literature the work-related activities that most commonly lead to injury in health professionals are lifting heavy equipment and patients, transferring patient, maintaining the same posture for a long period, manual therapy practices, responding to patients' sudden movements, and repeated movements.[9]

Bork identified the main causes of WRMDs in physiotherapists as staying in the same position for a long time and continuing to work when tired; Molumphy emphasized lifting and leaning downwards with sudden maximal effort; and West highlighted maintaining the same posture for along time, manual therapy, repeated movements, and increased work load.[9]

Table IV and graph IV Shows that 49% of subjects had back pain.

This may be because the physically demanding nature of physiotherapy itself may contribute to the development of musculoskeletal problems. Elements of physiotherapy practice which may be considered risk factors include, for example, treatments which demand repetitive movements or continuous bending, twisting and lifting; the tasks, postures and high force levels required for certain manipulations and mobilisations; providing manual resistance; the difficulty in performing safe handling techniques due to a patient’s condition and size or shape, particularly where there is a restricted work space; and a work environment made stressful because of an emphasis on high throughput (productivity) and/or understaffing.[7]

Each activity involves the application of relatively high levels of force, and each activity may have to be performed in hazardous postures.[8]

The incidence of WRMDs among physiotherapists was highest in low back, neck, shoulders and upper back.[9]

Table V and graph V shows highest deviation in cervical range of motion of side flexion (right) when compared with normative data of cervical range of motion.

Table VI and graph VI shows highest deviation in lumbar flexion range of motion when compared to normative data of lumbar flexion.

Table VII and graph VII shows highest deviation in lumbar range of motion in 2-6 hours of work.

Table VIII and graph VIII shows highest deviation in lumbar range of motion when compared to years of working.

Table IX and graph IX shows that maximum subjectst that had 1 year of experience had reported highest musculoskeletal pain.

The occurrence of injuries at work differs between junior- and senior-level therapists. Previous studies have cited that the incidence of work injuries is the highest within the first 5 years of practice, and it is common in junior physiotherapists and newly qualified graduates. Some research results have indicated that new physiotherapists are involved in the rotation of clinical postings in various specialties that may also expose them to a higher risk of injuries during their work.[10]

CONCLUSION

Current study concludes that there are deviations in spinal range of motion of graduated physiotherapist due to nature of work, hours and years of work.

Study shows that lumbar flexion is maximally affected and maximum physiotherapist reported back pain amongst the musculoskeletal disorders.

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