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RESEARCH ARTICLE

RELIABILITY OF SHADOW GONIOMETER FOR THORACOLUMBAR SPINE EXTENSION RANGE OF MOTION.

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Abstract

Introduction:-

Range of motion (ROM) is the arc of motion that occurs at joint or series of joints, ROM can be measured as Active ROM (AROM) and Passive ROM (PROM). AROM is the arc of motion attained by a subject during unassisted voluntary joint motion. Having the subject perform AROM provides the examiner with the information about the subject's willingness to move, co-ordination, muscle strength and joint ROM. Testing AROM is good screening technique to help focus a physical examination. If a subject can complete the AROM easily and painlessly, further testing of that motion is probably not needed. PROM is the arc of motion attained by an examiner during without assistance from the subject. The subject remains relaxed and placed no active role in producing the motion. Normally PROM is slightly greater than the AROM.Various factors that affect the ROM are Age, Gender, and whether the motion is performed actively or passively.[1]

The goniometry refers to the measurement of angles, in particularly the measurement of the angles created at human joints by the bones of the body. A variety of instruments are used to measure joint motion these instrument range from simple tape measures to electro-goniometer and motion analysis system.

The various motions occurs at the spine are - flexion, extension, side flexion, rotations. The existing testing procedures for spine ROM include – Double Inclinometer, Universal Goniometer, schober test, modified schober test, modified – modified schober test, prone press up, finger–to–floor test.

Double inclinometer introduced by karpovich and karpovich[15]in 1959, are used primarily in research to obtain the dynamic joint measurements. Most devices have two arms, similar to those of universal goniometer, which are attached to the proximal and distal segments of the joints being measured. Universal goniometer is the instrument most commonly used to measure joint position and motion in the clinical setting. Moore designed this type of goniometer as universal because of its versality. It can be used to measure joint position and ROM at most all joints of the body. The majority of the measurement techniques presented in this book demonstrate the use of the universal goniometer. In schober technique and modified schober technique simple tape is used to measure the ROM of the spine in inches.[1] Different testing methods of spinal range of motion and the mechanical as well as manual errors occurring with them provide distinct readings which further gives opportunity to do research and find the precise readings. Electrogoniometer measurements may be affected by abnormal sensory feedback while the axis of goniometer and the joint center of rotation are not coincided.[2] Some recent studies shows the measurement of extension of spine as to be rectified and more precise in future studies.

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Shadow goniometer was developed and designed to analyze ROM with minimal possible errors. The shadow goniometer was first made reliable and valid on knee joint. The shadow goniometer does not give visual, auditory and tactile cue when compare to other instruments. The advantages of shadow goniometer could be that ROM is not limited by movement of the subject or the goniometer, not affected by side and counters of the body parts. It will never produce abnormal sensory feedback. Hence the shadow goniometer can be superior to conventional goniometer is measuring joint position sense because neither the stationary arm nor moving arm of the shadow goniometer touches the limb. If it would have been touched the skin it can increase the joint position sense[2].

The high cost and the seldom availability of electro goniometers and isokinetic moving devices in Indian market gives less opportunity to do research as well as accurately measure the Range of joints. There is a great need for pure readings of the spine by health professionals' and physiotherapists and Shadow goniometer may serve this purpose. Anti-gravity position is used to attain a pure spine extension from neutral position. Any kind of trick movements is avoided and a pure extension motion is achieved with the shadow goniometer.

Procedure:-

Observational study done by three therapists on 30 healthy individual from the institution, both male and female with age group 18 to 25 yrs. were selected by simple random sampling method. Individuals with any musculoskeletal injury including low back pain, neurological disease, spinal deformities, any spinal surgeries, obese individuals and those who were unwilling to participate were excluded from the study. The materials used were OHP- overhead projector, protractor, set squares, long plinth, wide wall, and immobilization belt. Ethical approval was taken from the ethical committee for this research. Written Consent taken from all participants. The study was explained to three therapist and to all 30 the participants. Three therapists were asked to take reading for all 30 participants. The study was a double blind type. Markings were drawn on the ohp sheet with the help of protractor. Appropriate angle was set of the projector according to the heights of the subject. Then position was given to all participants as they made to lie prone on the plinth placed near the wall on which the OHP will be reflected. The patient's ankle was out of the plinth. The immobilization belts were applied first-on the hips and second- On the mid-thigh region. The centre of the protractor reflection was positioned on line extending from the S2 spinal process to the lateral region of the trunk and 0 degree on point extending from C_7 upto the lateral tip of the shoulder. The subjects were asked to perform the active extension of the spine in anti-gravity position by hands at the side. Body reflected point (BRP) was noted. Adequate rest period was given between two consecutive readings. All the three therapist noted separately for all 30 participants. The data was gathered from all three therapists and then data analysis was done with the help of SPSS version 20 software. The objective of the study was to measure the thoracolumbar extension range of motion by shadow goniometer. To find the Reliability of shadow goniometer for measuring the thoracolumbar spinal extension range of motion by shadow goniometer.

Fig.1 The above figure shows the active extension of thoraco-lumbar spine with shadow goniometer.

Fig.2 The above figure shows the alingment of the protractor above the overhead projector.

Data Analysis:-

Table 1:- Case processing summary of the 30 participants.

CASE PROCESSING SUMMARY		
	N	%

Subjects	Valid	30	100.0
	Excluded	0	.0
	Total	30	100.0

The above table shows that the total no. Of participants were 30 and none of them dropped out during the study.

Table 2:- Reliability statistics by Cronbach's alpha.

RELIABILITY STATISTICS		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Readings	N of Therapists
.648	.654	3

The above table shows that Acc. To the Cronbach's alpha and standardized readings the score was 0.64 and 0.654 respectively.

Table 3:- Statistical summary of the three therapists and their mean and standard deviation of readings.

STATISTICS			
	Mean	Std. Deviation	N
THERAPIST_1	16.33	1.061	30
THERAPIST_2	16.20	1.031	30
THERAPIST_3	16.30	1.208	30

The above table interprets that The Std. Deviation of the mean readings for three therapists was 1.061, 1.031 and 1.208 in order.

Table 4:- Variance calculation of the data collected.

SUMMARY STATISTICS							
	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Therapists
Item Means	16.278	16.200	16.333	.133	1.008	.005	3

The above table shows the minimum means reading is 16.200 and maximum is 16.333 and their difference ranged was .133, with variance of .005 proving the homogeneity of the ranges.

Table 5:- Shadow goniometer reliability with ICC

	Intraclass Correlation	95% Confidence Interval	
		Lower Bound	Upper Bound
Single Measures	.380[a]	.155	.604
Average Measures	.648[c]	.354	.821

The above table interprets that the reliability of the shadow goniometer ICC = 0.64.

Discussion:-

The objective of the study was to find the reliability of shadow goniometer for thoracolumbar spine extension ROM. Table one shoes the case summary of the subjects included in the study in which 30 were included and none of the subjects dropped out during the study. Table two describes the reliability statistics which shows the values of Cronbach's alpha with its standardized measures which shows the values as 0.64. Table three indicates the mean value and the standard deviation of all the subjects measured by the three therapists. Table four gives the values of the minimum and maximum ranges of the spinal extension of all participants and their and their variance which is 0.005. Table five shows the intraclass correlation as 0.64 and the 95 percent of confidence interval. Three therapists were included in the study and with regard to the measurement by 3 therapists the mean values were closely related.i.e. 16 degrees. The result of this study showed that the shadow goniometer is moderately reliable in measuring the spinal extension in degrees with ICC = 0.64 and considered to be highly significant with p value= .005. Therefore shadow goniometer can be considered as the reliable tool to measure the thoracolumbar extension ROM. Also this study indicates the clinical reliability of shadow goniometer as the mean reading score obtained by the three therapists was 16 degrees. Hence its application in the clinical set ups and physiotherapy opd is highly recommended. From Cicchetti (1994) guidelines for interpretation of ICC consider the measures of less than 0.40 – poor, between 0.40 and 0.59 – fair, between 0.60 and 0.74 – good, between 0.75 and 1.00 – excellent.

Numerous researches are being done to find a gold standard method to measure the spinal ranges. Studies have been reported with regard to reliability of thoracolumbar ROM using various types of testing tools and procedures in different positions. A study compared universal goniometer and the double inclinometer in which the interested reliability was poor for both instruments except for flexion using the goniometer.[8] Another study compared the reliability of the prone press up to measure lumbar extension under two conditions: with and without a strap to control pelvic motion. The interested reliability for both the strapped and unstrapped conditions good. (ICC=0.87 and ICC =0.85, respectively)[8] With the Back range of motion device (BROM) II had high reliability for measuring lumbar lateral flexion and low reliability for lumbar extension. Potential sources of the device over the sacrum during flexion and extension and variations in the identification of landmarks from one measurement to another.[9] A study compared the reliability and validities of four methods i .e. a tape measurement, a gravity goniometer, a parallelogram goniometer and a standard goniometer for measuring lumbar curvature and pelvic angle. Each of the methods has advantages and dis advantages that can affect the reliability and validity of the measurements or the ease of use of the instruments. No one instrument was found to be superior to the other.[10]

In this study we have managed to prove the reliability of shadow goniometer along with its clinical implication in the future.

Conclusion:-

The shadow goniometer is a reliable tool to measure the thoracolumbar spine extension ROM. The shadow goniometer can be used in clinical set ups. No funding was received for this research.

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Conflict Of Interest: -

There is no conflict of interest

Funding:-

No funding provided

Limitations:-

The limitation of the study was a small sample size, Study limited only for healthy individuals and lack of comparing the results with other measurement methods.

Future Scope of The Study:-

The study can be done on larger population also it can be clinically implemented. The Validity of the same tool can be examined.

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