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ANALYSIS OF HUMAN LUMBAR SPINE IMAGE WITH FEM ON VARIOUS MANUAL LIFTING LOADING CONDITIONS USING SOFT COMPUTING TECHNIQUES

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Abstract:
The Spinal Cord and the brain together make up the Central Nervous System (CNS). Spinal Cord nerves carry maximum messages between the brain and rest of the body. It is surrounded by protective membranes, and is enclosed within the vertebrae or back bone and a column of nerve tissues that runs from the base of the skull down the back. Due to this reasons, the anatomical structure of spinal cord is complicated to understand. Researches are developing to study the structure and the biomechanical functions of spine. In this paper, we discussed about a biomechanical model that has been designed and developed for optimizing the lifting posture with minimum effort and presented in this paper. The results of lifting is validated with two dimensional (2D) literature medical data which is obtained from Computed Tomography (CT) scan. Moreover many approach use data from corpse or animal. They never characterize the cause of difference between the improving or sick people. In this study, a Three Dimensional (3D) view model of the spine is demonstrated using Computed Tomography (CT) which is a latest digital biomedical technology equipment. This proposed model will provide a highly truthful and scrupulous catalogue information about the spine. This paper create a way to enormous applications like analysing the biomechanical performance of the spine, testing the spinal performance to check spinal is healthy or unhealthy and also to validate the planning phase of spinal implantation. To analyse the function of Human spine, it mainly focused on the Lumbar vertebrae (L1- L5) which is a largest region of spine. A finite element model (FEM) is proposed to study and analyses the stresses on Functional Spinal Unit of human spine. Using the Ergonomics analysis of human spine using Finite Element Method (FEM), the stress - strain relationship of vertebra is calculated when they are subjected to various loading and unloading compression constraints. In addition to this, the Finite Element Analysis (FEA) of the spine bone under different loading conditions is beneficial in the assessment of diseases and at the same time, predict future risk of fracture. The entire analysis accomplished by a real time simulation software ANSYS. The three-dimensional (3D) model of the lumbar vertebra fashioned using CATIA using Computed Tomography (CT) scanned data. In addition to this, the Finite Element Analysis (FEA) of the spine bone under different loading conditions is beneficial in the assessment of diseases and at the same time, predict future risk of fracture. This proposed model can also be employed in forecasting the lifting abilities of individuals.

Keywords:
Lumbar spine, Biomechanical model, Manual Material Handling, Finite Element Modelling, CT scan, CATIA, ANSYS.

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1. INTRODUCTION

The spinal cord is a long, thin, tubular bundle of nervous tissue and support cells that extends from the medulla oblongata in the brainstem to the lumbar region of the vertebral column. The brain and spinal cord together make up the central nervous system (CNS). These act as massagers or connectors between the brain and the rest of the body. Furthermore, these bones which are commonly called vertebrae with its length form the spine that surrounds this superhighway connector. The vertebrae are stacked one to the other at the top of it, while the nerves are between them. Then all these form the main part of the human spine that runs from the pelvis to the skull base. The bony spinal anatomy is a complex structure designed to support the weight of the higher body, allow physiologic motion, and care for the spinal cord[14].The spine is made up of vertebral bodies, which are composed of a tough external shell of cortical bone and a spongy inner structure of trabecular bone.

The human spinal column is made up of 33 bones - 7 vertebrae in the cervical region, 12 in the thoracic region, 5 in the lumbar region, 5 in the sacral region and 4 in the coccygeal region. Then, these individual vertebrae are with respect to their regions and positions.

Name of the Region	Number of the Vertebrae	Locational Area in Body	Notation
Cervical	7	Neck	C1 – C7
Thoracic	12	Chest	T1 – T12
Lumbar	5 or 6	Low Back	L1 – L5
Sacrum	5 (fused)	Pelvis	S1 – S5
Coccyx	3	Tailbone	None

Table 1: Tabular description of different vertebra regions and its notation

.Ranging from the superior to the inferior we have seven cervical vertebrae (C1-C7); twelve thoracic vertebrae (T1-T12); and five lumbar vertebrae (L1-L5). The remaining 9 bones of the spine are respectively called sacral (fused) vertebrae (S1-S5) and coccygeal (3-5) vertebrae (tailbone) as shown in Table 1. The vertebra can be divided into two parts – the anterior body and the posterior elements[4]. The anterior body takes most of the compressive loading of the spine. It consists of a spongy trabecular bone surrounded by a cortical shell. The posterior elements, which consist of the pedicles, lamina, ansverse processes and spinous process, forms a protective arch over the cord that resides posterior of the vertebral body.

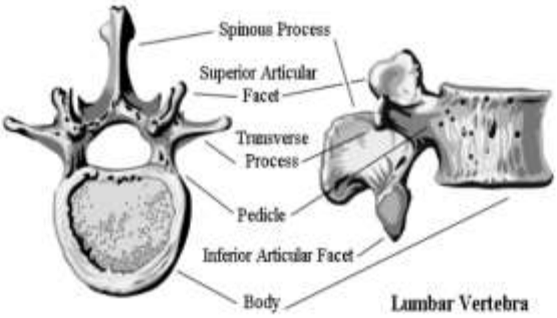

Fig 1: Diagram of Anatomy of lumbar vertebrae

A functional spinal unit (FSU) consists of two vertebrae, a disc, two facet joints and other structures that span between these two vertebrae. In an entire spine, the vertebra region considered as critical area that tend to as axel point when additional load is loads on facet joints[5]. Due to this action the effect of spinal occurs in human body. A larger distance between the facet joints and the vertebral body that tend to causes an increased bending effect and stress on human spine. This is also considered as the basic functional unit of the spine, and used to estimate the spine related disease, deterioration and implantations of spinal biomechanics[13].

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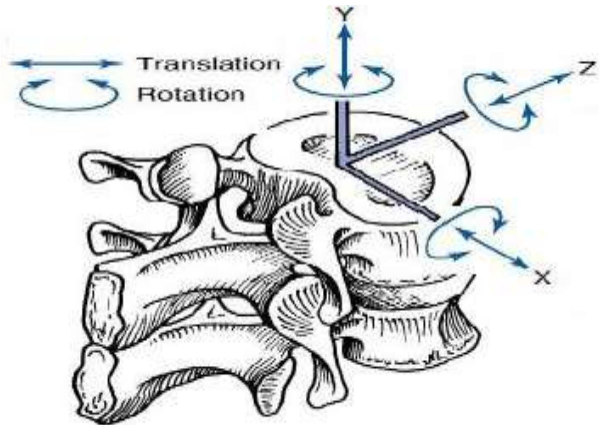

Fig 2: Six Degrees of Freedom of Functional Spinal Unit

2. MATERIAL AND METHOD

2.1. FINITE ELEMENT METHOD

The Geometrical model of the lumbar vertebral segment L4-L5 was reassembled based on a computed tomography (CT) scanned image data of the human spine[6]. The obtained data has loaded and segmented to develop a three dimensional (3D) model of vertebral segment[7]. This is implemented by using image processing software Mimics 14.0 (Materialize, Leuven, Belgium). The vertebral body was separated into cortical and cancellous bones in which the thickness of the cortical bone is 1 mm. The anatomical CATIA tool and pre-processing (meshing) software is combined with 3-Matic 7.01 software (Materialize, Leuven, Belgium). Using this 3-Matic 7.01 software, the surfaces of L4 and L5 were smoothed and re-meshed

The second step consists of modeling phase in which the vertebrae were remodeled as an elastic orthotropic structure. This structure is accomplished using Young's Modulii and Poisson's ratios that are obtained through the mineral bone density. The maximum and minimum values of the young modulii (Ex, Ey, Ez) are taken in three directions say x, y, z and that are summarized in the Table 2. The same table gives the values of the shear modulus (Gxy, Gyz, Gxz) and three Poisson ratios (vxy, vxz, vzx). The intervertebral disc of spine that shown in Fig **6** is separated into the annulus and pulpous part using Young's Modulii and Poisson's ratios. These ratio values were taken from literature medical data that is obtained from Computed Tomography (CT) scan. Cartilages fibers are also taken into account for analyzing the bone of human spine. Table 2 additional provides the material properties of lumbar spine. All these parts are simplified as a structure with an isotropic and linear elastic behavior. Based on the outcome of proposed model, the spinal cord tissue has roughly analogous rheological properties as ligamentous tissue. An average elastic modulus of the spinal cord is found to be equal to 1.40 MPa. An isotropic elastic behavior is also established for this physiological part. Three dimensional finite element model is built up using the CT scan of the L1-L5 lumbar unit including mechanical properties designed for the five vertebrae, the four intervertebral discs, the ligaments (anterior, posterior, flavum, interspinous and supraspinous), articular and capsular parts, and spinal cord (cauda equina). The numerical modelling based on a finite element methods (FEM) simplifies the structure whether it is anatomical or not by reflecting its mechanical properties. This method requires specification of the geometry of the modeled structure, the loads and pressure applied to that structure, and the elastic properties of the components[3]. The geometry is subdivided into small regions (elements) and the differential equations governing the deformation of solids are numerically solved[2]. Computed quantities include local deformations in response to the applied loads, as well as the corresponding stresses[10].

Three steps are needed to accomplish these tasks:

1) Classification of the geometry of the column constitutive parts;
2) Establishment of the various stress and part of the lumbar spinal unit;
3) Assessment of the model by performing arts a series of numerical computations.

2.2 BIOMECHANICAL APPROACH

The biomechanical approach refers to kinetic or kinematic analysis of the body parts under a Manual Material Handling (MMH) mechanism. The mechanical stresses forced on the spinal column are related with the stress tolerance limit of the spine in order to determine if the task under deliberation is within the tolerable range. The mechanical stresses are created under a different conditions like weight, load size, etc[11]. However, some limitations exist with the biomechanical approach, mainly on the efficiency of the biomechanical models[8]. Even the currently available best models have the variance in the experimental data which is mysterious.

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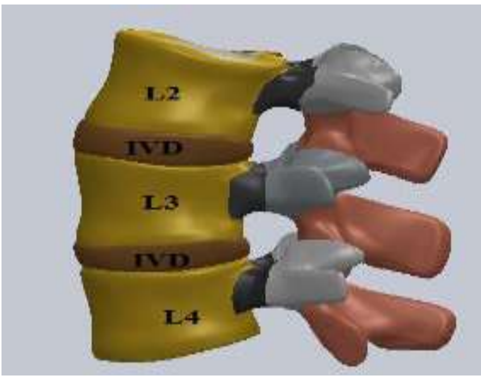

Fig 3: Diagram shows Human Lumbar vertebrae with their corresponding Intervertebral Disc

The various factors that effects the spinal loading are;

- Mechanical characteristics of the spine
- Spinal loading types in practical MMH task
- Part of intra-abdominal pressure (IAP)
- Relationship of the trunk and hip muscles
- Relative load distribution between the active and passive tissues which stabilize and safe guard the lumbar spine.

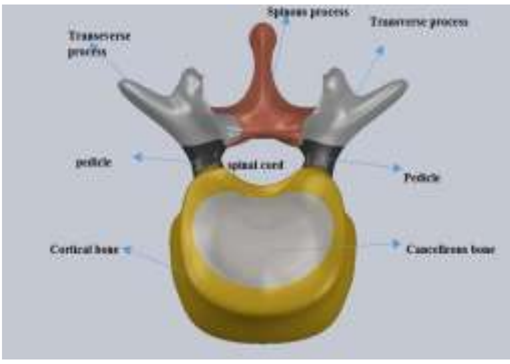

Fig 4: Graphical repression of lumbar vertebrae regions

2.3 MANUAL MATERIAL HANDLING

Manual Material Handling (MMH) mechanism is used for the following process that includes lifting, lowering, pushing, pulling, carrying, moving, holding and restraining, and incorporates a large part of the activities of working life[9]. Biomechanics has clear direct significance to manual handling work, since muscles must move to carry out tasks. The result of MMH clears the solution based on scientifically researched criteria that how much load can be handled without damage to the body. This criteria is known as the biomechanical criterion. The example of biomechanical criteria are muscle strain, disc injury or joint problems.

Three different criteria to be considered while lifting process. They are;

- Psychophysical Criterion
- Biomechanical Criterion
- Physiological Criterion

In Psychophysical Criterion; if the routine work performs every day, the anxiety will give solution for how the person feels about the task. In Biomechanical Criterion, if greater stress subjected on the bone, the anxiety will give solution about the withstanding capacity of muscles and joints. In Physiological Criterion, if the rate of work is too large, then it may exceed to the aerobic capacity of the individual. Using Manual Material Handling task, many factors are determine degree of the load placed on the body. All of criterions of MMH recommend the chances for prevention.

2.4 POSTURE AND MOVEMENTS

If the task requires an individual to twist or reach forward with a load, then the risk of damage is high. The workspace can often be reformed to prevent these actions. Lumbar spinal cord injury may be absolute or fragmentary, that may affect one or both sides of the body. While considering the other spinal cord injuries, the comprehensiveness of the

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spinal cord damage will determines the impact of injury and its symptoms. It is important to clearly understand the anatomy of lumbar vertebrae. The lumbar vertebrae are much different than the upper segments of the spine because the spinal cord does not prolong the entire length of the lumbar spine. L2 is the lowermost vertebral segment that contains spinal cord tissue. After that point, nerve roots exit with each of the remaining lumbar levels of the spine. During walking and prolonged standing position leads to Neutrogena claudicating that causes sphincter disorder. In few cases, these degenerative lesions exist whereas the clinical phenomena did not appear during rest. In medical revues, the spinal component displacement have been often related to neurological deficits or complications after lumbar spine manipulations. Most back injuries are cause while lifting, particularly that affects ground level compared to mid-thigh level, and this suggests simple preventive measures. The same measures are employed with high lifting task. The load itself may impact handling mechanisms due to its weight and location. Other factors like shape, stability, size and vagueness may consequence the ease of a handling task. A Physical and temporary workspace of an organization and environment also effects handling task. The work style of the person have to be altered. One of the recommendation to alter work style is to extent the burden of unloading a truck over several people for an hour instead of to employ one worker to spend all day on the task. Some of the environment influences handling are poor light, disorderly or uneven floors and poor housekeeping which leads to may cause a person to accident.

2.5 PERSONAL FACTORS

Personal handling skills like age of the individual and the garments worn by the individual may influence handling necessities. Awareness to be created regarding the lifting loads among the people. Additional, provide the necessary and important information about the physical skills of handling. Younger generation people are supplementary at risk; whereas, older generation people have less strength and less physiological capability. Most of people wear tight clothing which increase the muscle force and hence people felt strain against the tight cloth.

2.6 RECOMMENDED WEIGHT LIMITS

2.6.1 NIOSH:

$$RWL = LC \times HM \times VM \times DM \times AM \times CM \times FM$$

Where

- **RWL** denotes the recommended weight limit for the task
- **HM** denotes the horizontal distance from the centre of gravity of the load to the midpoint between the ankles
- **VM** denotes the vertical distance between the centre of gravity of the load and the floor at the start of the lift
- **DM** denotes the vertical travel of the lift
- **AM** denotes an asymmetry factor–the angle the task deviates from straight out in front of the body
- **CM** denotes a coupling multiplier–the ability to get a good grip on the item to be lifted, which is found in a reference table
- **FM** denotes a frequency multipliers–the frequency of the lifting.

2.6.2 LIFTING INDEX

By comparing the weight to be lifted in the task and the RWL, a lifting index (LI) can be obtained according to the relationship:

LI= (weight to be handled) / RWL.

Therefore, a particularly valuable use of the NIOSH equation is diagnosing lifting tasks helps to determine the order of severity and the lifting index is to set priorities for action[1].

2.6.3 BOUNDARY CONDITIONS

The accuracy of the FE analysis is dependent on the work consumed, if higher request like cubic, quadratic and so on are consumed then the components are not utilized as expected. In this stage if all phases of preprocessing is done effectively then, then a better result will be produced instead of coarser result. At any instance if a state of consistent losses then it leads to the elongate thickness of the image and neglects to deliver a critical change in the results. If the expected state of consistence is achieved then, the work is said to be successful. This approach of refining the work and delivering the result is known as a "work joining" study or examination. Though numerous FE codes contain "fault assessments" of some sort, in that cases the work become more complicated so that the most solid method to be employed to find the accurate results. Because of these reasons it's necessary with a computer preprocessor which help with mesh plotting and boundary conditions plotting. Coarse networks often report anxieties in a model. It is better to have most extreme reported weights to produce a precise results on a coarsely fit model. Thus, by implementing the above FE analysis phenomenon into the work then the feasible flawless outcome been produced as end product.

2.6.4 MESHING

The main objective of a subject-specific finite element model (FEM) is to estimate the geometrical parameters[12]. Using predicted geometrical parameters, we can create the finite element mesh and provide description

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about the material properties and all the procedures associated with the given subject. Direct conversion is the popular method for creating a subject-specific mesh of the vertebrae. In this method, the finite element mesh are produced from image voxel to hexahedral. Hence, the segmented region of the image is extracted and each image voxel is directly converted to a brick element in the mesh. Materials properties are described in an element-by-element fashion using obtained densities calculated from the image data[15]. The density value is mainly calculated for each element which depends on the image intensity associated with that region. Then computed density is applied to estimate the Young's modulus value for that element. Many equations are employed to compute the modulus value. However, to generate more precise material properties of vertebrae tissue is still challenging for most image-based models.

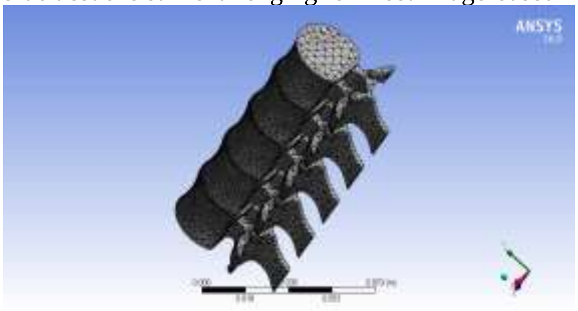

Fig 5: Diagrammatic illustration of Meshing of the Spine

Meshing has been carried out by employing the fine components of Tetrahedron method. In Tetrahedron method, the segmented is insulated into little triangle on its apparent which gives number of pivots and components of that segment.

3. RESULTS AND DISCUSSION

3.1. LOAD DISPLACEMENT

The loads were subjected on the L1 superior surface in following measurements; 500, 550, 600, 650, and 700 N as shown in Table 3. The L1 superior surface tolerates a 500N load in which a healthy person weighted 70 kg, stands straight in relaxation state as shown in Fig 8. When the heavier load forces on the L1 superior surface tolerates with the results of load displacement behavior in axial compression. This tolerance level demonstrates that the vertebral bone has flexible biomechanical physiognomies. If greater load is applied on the spine bone, then the stress concentration may be greater in pedicle region. As a result, the displacement of L1 vertebral bone initiated by compressing the vertebral body and the superior articular processes in downward direction. Accordingly, the movement of vertebral due to the applied load and restraints subjected on the model creates the high dense of stress in the pedicle region of spine.

The Fig 7 depict the maximum stress distribution of the spine. The high stress concentration on bone is created by applying the maximum loading weight of 700N. Due to this maximum limit of loading, greater stress concentrations created around the vertebral body and pedicle region which mainly affects the upper body of vertebral bone of spine.

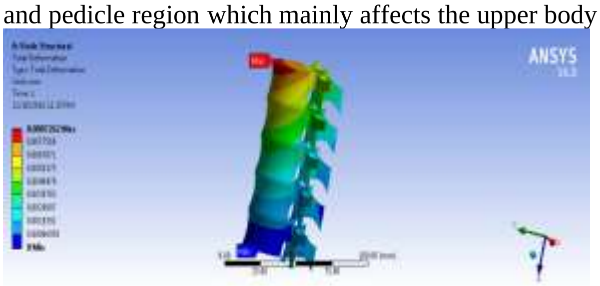

Fig 6: Diagrammatic illustration of Distortion of the lumbar spine

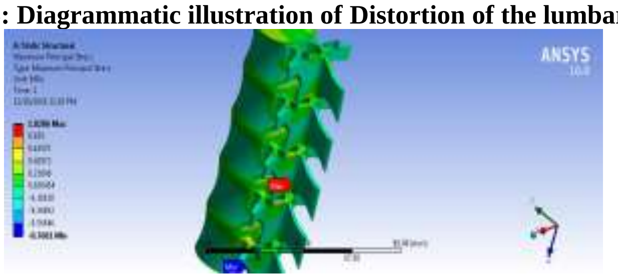

Fig 7: Diagram of Maximum Stress of the lumbar Spine

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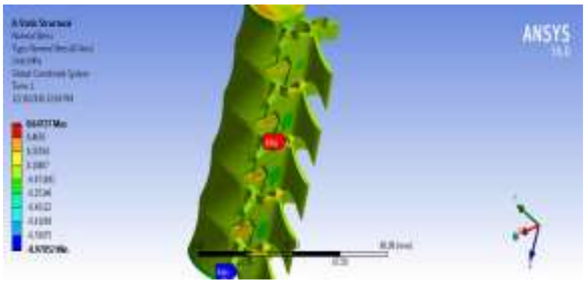

Fig 8: Diagram of Normal Stress of the lumbar spine

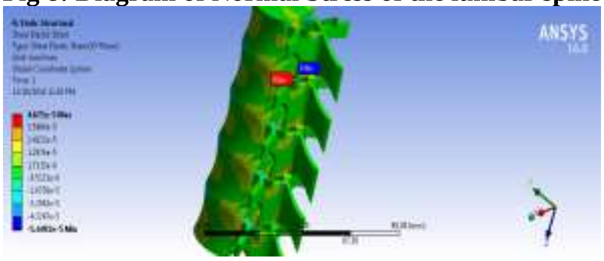

Fig 9: Diagram of Shear Elastic Strain of the lumbar spine

Fig 10: Diagram of Shear Stress of the lumbar spine

Fig 11: Diagram of Strain of the lumbar spine

Fig 12: Diagram of Normal Elastic Strain of the lumbar spine

ISSN: 2456-9348
Impact Factor: 5.004

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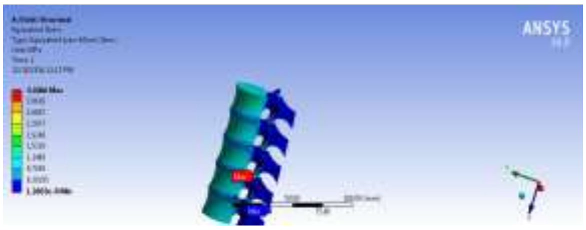

Fig 13: Illustration of various Stress of the lumbar spine

The post processing stage deals with the demonstration of discovered results. In this section of finite element analysis the following thing are calculated namely; distorted configuration, mode shapes, temperature, and stress distribution. After successful computation of above specified units, they have to be visualized. For displaying enhanced post processing module of DTI information of the spinal rope, the custom based pipeline is utilized. Therefore, two vortex current approach and movement amendment approaches were analyzed using three-dimensional relative (3D-relative). Likewise, displayed another vigorous tensor-fitting strategy that reins for whole volume anomalies. Using vigorous tensor-fitting strategy the large 3D-relative enlistment enhances its information quality. At the same time, it can fail to record the processes because it's a one-sided tensor and misregistrations evaluations. The proposed vigorous tensor strategy provides the appropriate minimal error recording predisposition and also produce more solid tensor assessments. Using the strong tensor strategy the better results are produced. Some of them are smart cutting or adjustments of spines and good medication for the vortex current. Strong tensor fitting and using decreased misregistrations yield the best results. For the practical implementation, the above specified strategy has one limitation, that is, the image of spine bone is broken down which reduces the natural quality of an image. To overcome this issue, an appropriate and effective common frequencies are to be examined in modular investigation phase.

Table 2: Tabular representation of various loading conditions

Load (N)	Total Deformation (mm)	Equivalent (von-Misses) Stress (MPa)	Equivalent Elastic Strain (MPa)
500	8.7262e-003	3.4466	2.3143e-004
550	9.5988e-003	3.7912	5.1381e-005
600	1.0471e-002	4.1359	5.6052e-005
650	1.1344e-002	6.0723e-005	4.4805
700	1.2217e-002	6.5394e-005	4.8252

The Spine bone of Human beings has a capable to withstand 50 kilogram of weight regularly. Accordingly a sum of 490N acts from the vertical region of Cervical Vertebrae. Similarly the stomach weight of 0.5 MP greatest which goes almost as the heap in the Lumbar Vertebrae. Spine bone is tightly bounded on the Sacrum and Coccyx territory region. It shows the joined stacking in the cumulative spine bone. The boundary conditions for the various cases use a settled base of the lumbar human unit (in the three headings) and provides the proper load analysis for each displayed case. For the illustration of pressure, a weight is fixed to the uppermost surface of the geometry to guarantee the homogeneity of the allied load. The weight is recorded by detaching every heap by the range situated on the primary lumbar vertebrate L1.

4. RESULT AND DISCUSSION

The Computed Tomography (CT) image based finite element modelling FEM can deliver a deep knowledge of the biomechanical effects on the lumbar and other associated pathologies. Using the simulation software ANSYS, it visualize the biomechanical parameters of lumbar tissues. Stress and strain relationship is been derived using the proposed model.

Table 3 tabulates the overall manual lifting condition of bone when they are subjected with varying loads of following measurements namely, 500N, 550N, 600N, 650N, 700N and 750N. This tolerance level demonstrates that the vertebral bone has flexible biomechanical physiognomies. Based on the varying manual lifting conditions we found that,

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maximum loading condition leads to greater stress concentrations on bone and mainly affects the upper region of vertebral bone of spine.

Table 2 tabulates the different load condition and their corresponding stress and strain values. Using this value we cannot proceed because the friction coefficient values are nearer and not clear. In this case, all the material parameters assumed and simplified based on hypothesis of some degree. It is a simplified model in which we cannot determine the variability of shape and material properties of the bone of a person. The boundary between two bones has only analyzed and simulated so for in past researches. This model provides the clear picture of only one segment of the whole spine. The results obtained may change when it performed with whole spine. In modelling many uncertain factors may change the result. By taking into account of above reasons, though a finite element model (FEM) having some drawbacks, it analyze and visualize the biomechanical physiognomies of the lumbar effectively.

5. CONCLUSION

By this study, we clearly understand that the lumbar is an important organ to withstand maximum weight. Moreover, the intervertebral disc can retain the elevation of the spine and also connecting the adjoining vertebral segments. Experiment is conducted with various manual lifting condition of bone when they are subjected with varying loads of following measurements namely, 500N, 550N, 600N, 650N, 700N and 750N. The Experimental result shows that a normal disc can withstand a load of 30 kg but it can withstand beyond the normal level of loading weight when exercising aggressively or lifting heavy things. A normal human being can withstand the loading ranges from 500 to 2500 N. While the loading weight exceeding this threshold, then the nucleus pulpous will be damaged or injured. In our study, we applied some distortion factors to analyze and simulate the stress and strain distribution of lumbar spine. The result of distortion implies that cancellous bone and cortical bone withstand the force together and high dense of stress acts on the pedicle region of spine. From the tabulations we came to know that the extrusive posterior and the lateral is superior to other directions. The tolerance level demonstrates that the vertebral bone has flexible biomechanical physiognomies. The entire analysis accomplished by a real time simulation software ANSYS using finite element analysis FEM method. The proposed work effectively analyzed and simulate the biomechanical physiognomies of lumbar spine under various loading conditions.

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Object Name	Min/Max	Load@ 500	Load@ 550	Load@ 600	Load@ 650	Load@ 700
Total Deformation	Min	0. mm	0. mm	0. mm	0. mm	0. mm
	Max	8.7262e -003 mm	9.5988e -003 mm	1.0471e -002 mm	1.1344e -002 mm	1.2217e -002 mm
Equivalent Elastic Strain	Min	1.3327e -012 mm/mm	2.7831e -012 mm/mm	3.2537e-012 mm/mm	3.6059e-012 mm/mm	3.7128e -012 mm/mm
	Max	2.3143e -004 mm/mm	2.5457e -004 mm/mm	2.7771e -004 mm/mm	3.0086e-004 mm/mm	3.24e -004 mm/mm
Shear Elastic Strain	Min	-5.4492e -005 mm/mm	-5.9941e -005 mm/mm	-6.539e -005 mm/mm	-.0839e-005 mm/mm	-7.6289e -005 mm/mm
	Max	4.671e -005 mm/mm	5.1381e -005 mm/mm	5.6052e -005 mm/mm	6.0723e-005 mm/mm	6.5394e -005 mm/mm
Normal Elastic Strain	Min	-1.7421e -005 mm/mm	-1.9163e -005 mm/mm	-2.0905e -005 mm/mm	2.2647e-005 mm/mm	-2.4389e -005 mm/mm
	Max	5.7111e -005 mm/mm	6.2822e -005 mm/mm	6.8533e -005 mm/mm	7.4244e-005 mm/mm	7.9955e -005 mm/mm
	Min	1.2603e -008 MPa	1.2961e -008 MPa	1.7353e -008 MPa	1.3814e-008 MPa	1.6217e -008 MPa
	Max	3.4466 MPa	3.7912 MPa	4.1359 MPa	4.4805 MPa	4.8252 MPa
Equivalent Stress	Min	- .31438 MPa	-0.34581 MPa	-0.37725 MPa	-0.40869 MPa	-0.44013 MPa
	Max	0.26948 MPa	0.29643 MPa	0.32338 MPa	0.35033 MPa	0.37727 MPa
Shear Stress	Min	-0.7681 MPa	-0.84491 MPa	-0.92172 MPa	-0.99853 MPa	-1.0753 MPa
	Max	1.0286 MPa	1.1315 MPa	1.2344 MPa	1.3372 MPa	1.4401 MPa
Maximum Principal Stress	Min	-0.97052 MPa	-1.0676 MPa	-1.1646 MPa	-1.2617 MPa	-1.3587 MPa
	Max	0.64737 MPa	0.71211 MPa	0.77684 MPa	0.84158 MPa	0.90632 MPa
Normal Stress	Min	1.3327e -012 mm/mm	2.7831e -012 mm/mm	3.2537e -012 mm/mm	3.6059e -012 mm/mm	3.7128e -012 mm/mm
	Max	2.3143e -004 mm/mm	2.5457e -004 mm/mm	2.7771e -004 mm/mm	3.0086e -004 mm/mm	3.24e -004 mm/mm

Table 3: Overall analysis of Manual Lifting Condition

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This biomechanical physiognomies of lumbar spine greatly helps the surgeons to sort better verdicts to cure spine related disease.

FUTURE WORK

In the further study, the appropriate models to be simulated for the bones like cortical bone, cancellous bone, and ligaments, which helps to increase the accuracy of results. Generate and test the stress and strain distribution under torsion and shear conditions that helps to simulate the biomechanical characteristics of lumber during an operation. Moreover using this proposed method, analyze the bone structure with extended cross sectional views to different of human bones. Furthermore, this paper provides the idea of estimation of bone material properties and their fluid flow mechanisms. By embedding some advanced future work to this proposed work, this application can be effectively used in the field of Oncology and Radiation Therapy.

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