CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

The understanding of the positions of lumbar spine is necessary when the spinal spatial configuration, posture, motion and loading are estimated. The functions of the lumbar spine are to provide flexibility, support of the upper body weight, and protect the spinal cord and nerve roots (Chen-Sheng Chen a. 2001). With increasing costs of low back pain and spinal disorders, spinal loading during daily life activities is on the focus of present ergonomic research.

Some disease and several loads may cause compression in vertebrae and make the spine become unstable. These vertebrae of lumbar spine are carry the most amount of body weight and are subject to the largest forces and stresses along the spine. As an important human load bearing structure, the lumbar spine has a variety of clinical manifestations because of its complex physical structure. And that is mainly related to congenital physical structure of the lumbar vertebrae and its load bearing in the whole spine. The mechanical load can aggravate low back pain and disc degeneration (Videman T. 1990). Therefore, in clinic, many methods of bone fusion or non-fusion fixation are applied to achieve anatomical reduction and fixation, thus increase three-dimensional stability of the spine (Zhang and Chen et al. 2007). Using the three-dimensional numerical analysis and test the state of stress and deformation of the spine under the actual stress, is an effective way to obtain mechanical changes under a variety of force.
This study attempted to further investigate the mechanical behavior of lumbar spine by finite element method (LI Zhuo-dong. 2009).

Finite element analysis (FEA) was first proposed by Richard Courant in 1922 ironically during an era in which the method was impractical due to the laborious process of solving linear systems of equations by hand. It was not until the advent of the digital computer in 1942 that the method became practical. Indeed, John Argyris is usually credited with making the method suitable for nontrivial problems in the early 1950s when he published a series of papers outlining the technique and realized the critical role that computers would play in the viability of the method. Although the finite element method gained popularity in many engineering disciplines throughout the 1950s and 1960s, it was not until 1973 that the technique was applied to the human spine. However, little information has focused on stress alteration of the lumbar spine. (Steven and Avram 2006)

1.2 PROBLEM STATEMENT

The vertebrae are a complex shaped structure whose mechanical behavior is not clearly understood. It has been argued that a clarification of the mechanical causes of low back pain requires the knowledge of the states of stress throughout the lumber region. Therefore, in order to help explain the structural changes that accompany the degenerative process, this study proposes to analyze stress alteration of the lumbar spine by using the finite element method. The important of this study is to get some additional information of the lumbar spine, a doctor become easy to operate the patient when do the operation.

1.3 OBJECTIVE OF THE RESEARCH

The objectives of the research are to analyze the highest stress that concentration on the lumbar spine L1 and L2 (L1-L2). Also to investigate which location will be high stress concentration if the movement of axial compression, flexion, extension and lateral bending. Furthermore is to investigate the different size of meshing to get the optimum size for the accuracy result.
1.4 PROJECT SCOPE

This focus is based on the following aspect:

(i) Limited to male age between 20 until 30 years old.
(ii) Average weight for male around 63kg until 81kg.
(iii) Average height for male is 163.5cm.
(iv) Focus on 3D solid body of lumbar spine
(v) Perform a simulation test by using finite element method.
(vi) Analyze the problem by using MSC Patran software for pre and post processor.
(vii) Solve the problem by using MSC Nastran software.
(viii) Numerical method only not for the experiment.

1.5 SIGNIFICANT OF THE RESEARCH

When research is complete more information will get from the finite element analysis. From the way complex movement and variable loading been applied. Another than that, it will easy for the clinical to know which part of location that patient have problem.