CHAPTER I
INTRODUCTION

1.1 Background

Thoracolumbar is the most often fractured part in the spine[1]. It had been recorded by Wang et al.[1] that 54.9% of patients had injuries in thoracolumbar in a comprehensive series of 3142 patients at high risk spinal fractures. Thoracolumbar fracture results from several axial loading of the spine usually due to fall, vehicle accident, etc[2]. Thoracolumbar fracture can lead to some serious injuries like significant disability, deformity and neurological deficit[3].

Posterior instrumentation with pedicle screw and rods had been the most used method for surgical stabilization[4]. Surgical treatment of thoracolumbar fracture was aimed to decompress the neural tissue, stabilize the columns, which requires rigid fixation. With the recent advancements in spinal equipment and surgical procedures, modern spinal surgeons are well-prepared to rigidly fix the spine in complex cases[5]. In some instances, particularly with adult spinal deformity surgery, up to one-third of patients have radiographic and/or implant-related problems, which can range from implant prominence to broken screws or rods. [6].

With the increasing knowledge of various disorders involving spinal columns, spine surgery has also advanced significantly. Furthermore, there has been a rise in the general public's acceptance of spine surgery. Compared to earlier times, the frequency of spinal procedures has rapidly increased due to all these variables. Implants are competing with bone to fuse together. When an implant stops serving its intended purpose, it is considered to have failed. Implant failure can manifest itself in a variety of ways, including dislodgement, migration, fractures, and even spinal fractures. [7].

In practical applications, for large and load-bearing implants, require high stiffness and high strength so that the spinal implant can maintain stability. The loosening of implants is due to the too large interfacial micro-motion induced by the lack of stiffness. The fracture of rods and pedicle screw are due to the lack of strength.

1.2 Problem Formulation

The measurement of biomechanics object is challenging due to part of human body. So, to make it more easy to calculate without testing it directly, finite element analysis can be an option to analyze the phenomena of thoracolumbar fracture.

1.3 Objectives

The aim of this final project is to model and analyze the stress and stiffness that occurs in the spine and implants in cases of thoracolumbar bone damage using finite element analysis.

1.4 Advantages

The benefit of this research is that it provides an overview of the stress and stiffness that occurs in implants for surgeons as a consideration for getting better fixation results with implants for patients.

1.5 Scope of Problem

The scope of this research is:

1 The model in this simulation consists of thoracolumbar spine, ligament, pedicle screws and rods only.
2 The crack growth is neglected.
3 The material of model is homogeny and isotropic.
4 The load of model is static.

1.6 Report Outlines

The final project is generated in a systematical manner that complies with scientific writing guidelines. First chapter, the introduction, consists of the background, problem formulation, objectives, advantages, scope of the problem and the report outlines. Second chapter, literature review consists of the fundamental theory using in this research. Third chapter, Methodology, consists of types of research, instrumentation, procedures. Fourth chapter consists of result and analysis. Fifth chapter consists of conclusion.