Report Example 1/5

Courtesy of Dorcas Kaweesa

An example of writing introduction and background:

The importance of the subject.

What are the problems?

How to analyze the problem?

References.

ABSTRACT

Hip joints, being the largest joints in the body, bear the majority of the body weight. The weight bearing stress on the articular cartilage of the hip joint during regular activities such as walking, running, jumping, climbing up the stairs, among others is a minimum of 2.5 times up to about 5 times an individual's body weight. Damage to hip joint through accidents and hip bone multifactorial diseases place a high demand for the replacement with a prosthetic hip joint via surgical procedures. Prosthetic hip joints have been developed to simulate the functions of the human hip joint upon implantation. This paper presents the analysis two point loads applied onto the femoral head of a prosthetic hip joint. The results represent the potential areas where high stress might appear in the prosthetic hip joint. Ultimately, the higher the stress exerted on the prosthetic hip joint, the more likely it is to fracture in specific locations.

INTRODUCTION & BACKGROUND

A hip joint is a ball and socket type of joint that connects the femur (thigh bone) to the pelvis. The femoral head is covered with cartilage which allows the bones to move smoothly against each other. The muscles surrounding the hip joint are strong enough to prevent fracturing or dislocation. Since the hip joint is subjected to an applied load from the weight of the body, the hip bone and cartilage are likely to wear out causing pain and possible fractures. Some of the common problems associated with the hip bone include; congenital dislocation which is the displacement of the ball (femoral head) from the socket, fracturing of the bone in the shaft of the femur, osteoarthritis, a degenerative disorder that leads to the depreciation of the cartilage in the joint, etc. thus the bones rub together causing swelling and pain during movement [1].

Most often, severe hip damages like dislocations, fractures, and diseases such as arthritis are rectified by implanting an artificial prosthetic hip joint via a surgical procedure. In general, a prosthetic device is an artificial device that replaces a missing part of the body which might be lost as a result of diseases, congenital conditions, and trauma [1]. In this case, a prosthetic hip joint is an artificial device that replaces a hip dislocation. The process of replacing a hip joint with a prosthetic limb is known as hip replacement or arthroplasty whereby the prosthetic limb is fitted into the femur bone and the acetabular [2]. Research and development of hip prosthesis has been conducted since the earliest 20th century. Notably, Sir John Charnley introduced a metal femoral prosthesis connected to the bone with poly (methyl methacrylate), PMMA which was made of ultra-high-molecular-weight polyethylene hip replacement (UHMWPE). Sir Charnley's development of a hip prosthesis has advanced over the years but the basic idea of the design is still applied to modern hip prostheses [3].

The maximum force that is exerted across the hip joint during activities such as walking, running, and climbing up the stairs, among others is estimated to be a minimum of 2.5 times up to about 5 times an individual's body weight [4]. In order for prosthetic hip joints to emulate the functions of regular human hip joints, the hip implants are designed from materials whose mechanical properties are characterized by high strength, hardness, and resistance to fatigue. The femoral stem is typically made of titanium and the femoral head is made of cobalt chrome simply because these materials are not corrosive in the body and are durable. Titanium was first used in the mid-20th century to manufacture orthopedic implants basically because of its mechanical properties and suitability for use in implants [5]. Extra hardness, strength and corrosion resistance were also and are still required properties in prosthetic hip implants [6]. The prosthetic

hip joint is most likely to fracture due to fatigue failure around the neck between the femoral stem and head as well as at a position about a third from the bottom of the stem. The force applied onto the femoral head tends to be relative to the axis in the vertical plane relative to the femur bone dividing the model into two parts through the middle [6].

This report presents the finite element analysis of two different loads applied simultaneously onto the femoral head of a prosthetic hip joint. The applied loads were 2000 N and 5500N implied for individuals' weights of about 80kg and 225kg respectively. The body weights selected for this analysis are intended to depict an individual, most probably a very active young adult, who has a prosthetic hip joint as a result of a damaged or fractured hip joint due to intense activities. The other individual is depicted to be overweight who has a prosthetic hip joint as a result of excessive force applied to the person's hip joint.

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