

Total Knee Replacement

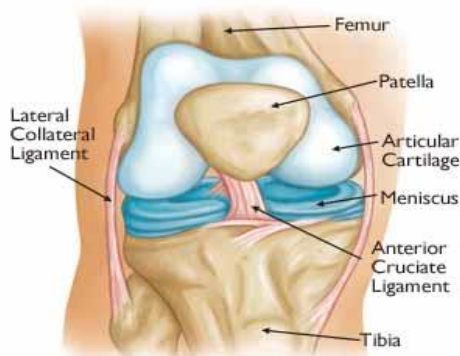
Matt Barbin, Biomedical Engineering, University of Rhode Island
BME 181 First Presentation, March 25, 2013 <matbarbin@my.uri.edu>

Abstract- Total knee replacement is for people with major arthritis in a knee. Total knee replacement uses specially designed components made of high strength, biocompatible metals and plastics to replace the cartilage in your knee. With a high rate of success, total knee replacement has proven to be a great way for people to restructure their knees and improve their quality of life.

I. INTRODUCTION

The knee is the largest joint in the body. The knee is made up of the femur (lower end of the thigh bone), the tibia (upper end of the shin bone), and the kneecap (patella). The ends of these three bones are covered with articular cartilage, which protects the bones and enables them to move easily. All remaining surfaces of the knee are covered by a thin lining called the synovial membrane. This membrane releases a fluid that lubricates the cartilage, reducing friction in a healthy knee. All of these components work in harmony with a healthy knee, but disease or injury can disrupt this and result in pain, muscle weakness, or reduced function. Arthritis is the most common cause of chronic knee pain and disability. Although there are many types of arthritis, most knee pain is caused by osteoarthritis, which is the number one cause of knee replacement with a diagnosis of 96% in total knee replacement recipients.

THE NORMAL KNEE

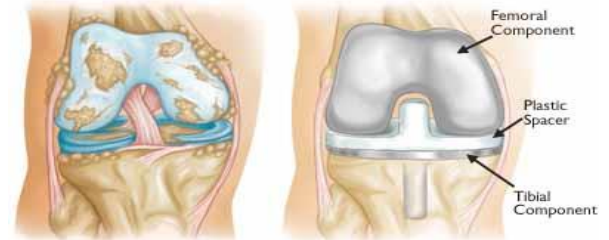


II. METHODS

Total knee replacement uses specially designed components made of high strength, biocompatible metals and plastics to replace the cartilage in your knee. Only the worn-out cartilage surfaces of the joint are replaced. The entire knee is not actually replaced. The collateral ligaments, muscles, and tendons are all left intact. The first step is to remove the damaged cartilage surfaces at the ends of the femur and tibia along with a small amount of underlying bone. The next step will explain what actually will happen to the knee. For the femur, a metal femoral component curves around the end of the femur. It is grooved so the kneecap can move up and down smoothly against the bone as the knee bends and straightens. The tibia component is typically a flat metal platform with a cushion of strong, durable plastic, called polyethylene. Some

designs do not have the metal portion and attach the polyethylene directly to the bone. For additional stability, the metal portion of the component may have a stem that inserts into the center of the tibia bone. The metal parts are mostly made of titanium or cobalt-chromium based alloys. For the kneecap, a patellar component made of a dome-shaped piece of polyethylene will duplicate the shape of the kneecap.

Damaged knee and newly replaced knee



Components are designed so that metal always adjoins with plastic, which will result in minimal wear. All together, the components weigh between 15 and 20 ounces.

III. RESULTS

After total knee replacement, 9 out of 10 patients said they experienced dramatic pain relief. 90% of knee replacements last 10 years and 80% last 20 years.

IV. DISCUSSION

The chance something of going wrong after the procedure isn't very high for total knee replacement, but as always there are certain risks that people should be aware of. Some of these risks are deep vein thrombosis, fractures, instability, loss of motion, and infection. A disadvantage is the cost; The United States has among the highest costs in the world for knee replacement surgery. An American with no health insurance typically pays \$45,000 – \$70,000 at a typical hospital. International costs of total knee replacement are much less than the United States. The current improvements of total knee replacement are very important to society because knee problems are pretty common among people today, especially older people. If methods of total knee replacement continue to improve, more and more people will have this procedure done.

REFERENCES

- [1] <http://orthoinfo.aaos.org/topic.cfm?topic=a00389>
- [2] http://www.kneereplacement.com/DePuy/About/about_surgery/before_during/index.html
- [3] <http://bonesmart.org/knee/knee-replacement-implant-materials/>
- [4] http://en.wikipedia.org/wiki/Knee_replacement
- [5] <http://www.healthline.com/health/total-knee-replacement-surgery/statistics-infographic>

