CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY

Name(s)

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Project Number

J1130

Project Title

Cartilage Replacement: A Technique to Prevent Traumatic Arthritis

Abstract

Objectives/Goals

Injury to cartilage may lead to a crippling disease called arthritis. It is one of the leading causes of disability in the U.S. Traumatic arthritis is a form of arthritis caused by injury or damage to cartilage. Cartilage is very difficult to rejuvenate and a cure has not yet been found. This experimental model was designed to test cartilage replacement to improve integration (healing) of the donor-recipient interface(common boundary).

Methods/Materials

Two models were tested: loose-fit(loose touching interface)and line-to-line fit (close touching interface)in order to see which would have the greatest integration and strongest interface after a period of healing. Hyaline cartilage was substituted in 2 bovine specimens. An osteochondral perimeter was made in the femoral condyle of the bovine knee at 2 locations to create a core. An osteochondral plug was taken from another portion of the bovine knee. It was inserted loosely and line-to-line into the region where the core was created. Once cartilage replacement was performed, the perimeter with the new donor plug inside was removed and placed in cell culture in an incubator until histological integration and mechanical tensile strength tests were performed.

Results

At 3 weeks, a line-to-line model resisted a mean of 2.31 grams of force. The loose-fit model was unable to resist any force. At 6 weeks, the line-to-line model resisted 2.05 grams of force. The loose fit model resisted 1.30 grams of force without breaking. The histological results for integration showed that the line-to-line model was 35% integrated and the loose fit model was 0% integrated at 3 weeks. At 6 weeks the line-to-line model was 99% integrated and the loose-fit model was 7% integrated. Data for mechanical tensile strength were analyzed using SPSS. Independent sample t-tests were used to compare the mean grams of mechanical force resistance between the 2 models at each measurement time(3 weeks and 6 weeks). A calculation was performed to obtain percent of histological integration.

Conclusions/Discussion

The line-to-line model resisted the greatest tensile forces and demonstrated the highest percent of integration. The line-to-line model was proven to be a more appropriate technique for cartilage replacement by demonstrating improved integration over a 6 week period. This may improve the long term survival of the graft and possibly prolong the time of progression to arthritis.

Summary Statement

This procedure was designed to test which model of cartilage integration would promote the greatest healng and resist the greatest mechanical forces as a technique to replace damaged cartilage which could prolong progression of arthritis.

Help Received

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