INTRODUCTION

Heart disease is the leading cause of death in the United States. Factors that increase the risk of heart disease include obesity and smoking, both of which are prevalent in today’s society. In 2004, cardiovascular disease claimed 36.3% of all lives lost, while coronary heart disease took about 452,300 lives. Coronary heart disease is the single leading cause of death in America nowadays. 15,800,000 people alive today have a history of heart attack, angina pectoris or both. [1]

These disturbing trends continue to make it increasingly obvious that heart attack research is an incredibly important field of study. This project was started in an effort to contribute to the advances that have already been made in heart attack research. The stresses and strains of Bullfrog hearts were studied in vivo with the ARAMIS Photogrammetry System, in conjunction with a pressure transducer. Bullfrogs were chosen for this experiment because their hearts can easily be studied in vivo, and because their structure is similar enough to relate to human hearts. Myocardial infarction was artificially induced using liquid nitrogen, applied to the middle of the ventricle.

THE ARAMIS PHOTOGRAMMETRY SYSTEM

The ARAMIS Photogrammetry System employs two high speed cameras (which have the capacity to capture 500 frames per second), to accurately measure the strains on any object over a certain period of time. In order to do so, first, a unique speckle pattern needs to be overlaid on the object of interest.

The speckle pattern consists of a white base coat which is applied to the entire surface of the object. Then, black speckles are laid over the white base coat. Usually, spray paint is used to make the speckle pattern. However, for this particular project, spray paint could not be used because of its damaging properties on the frog heart. Instead, a white titanium dioxide powder and a black charcoal powder were used to create the speckle pattern.

Once the speckle pattern is applied, the cameras take a series of images (at 50 frames per second). The system is then able to use an algorithm, tracing the deformation of the unique speckle pattern, to calculate the strain of the object at each frame. Also, a pressure transducer can be synchronized with the data acquisition portion of the Photogrammetry system to produce pressure data at each frame. The data can then be processed to yield useful videos and images which clearly show where the areas of high stress and strain are located on the beating heart.

RESULTS

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CONCLUSIONS

Due to time constraints and lighting issues, only one useful set of data was gathered. This data was gathered using polarized light at 50 frames per second. Although only one set of new useful data was collected, the project was still considered a great success. It was successful because a procedure was developed which will make future data collection much easier. Next term, Rachel Fitz will be working to understand exactly how the results affect the operation of the heart from a biological standpoint. Future research will attempt to further understand exactly how the change in strain concentrations affects the physiology of the heart. Also, a more consistent procedure for inserting the needle tip pressure transducing catheter must be developed. As of now, useful pressure data can only be collected less than half of the time because the heart becomes butchered from the current method of insertion.

REFERENCES