CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)
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Project Number
S1010

Project Title
The Effects on the Flow Rate, as a Representation of Stroke Volume and Cardiac Output, and Pressure on a Model Heart wit

Abstract

Objectives/Goals
the effects on the flow rate, as a representation of stroke volume and cardiac output, and pressure on a model heart with progressive atherosclerosis in comparison to that of a normal heart.

Methods/Materials
To test this experiment, a model heart was designed. A peristaltic pump was used as the main pump to circulate the blood through the tubing connected to the water bottles, and the chambers. In this model heart, the left side of the heart, the left atrium and ventricle, was the primary focus, in that this side of the heart is responsible for systemic circulation and therefore any atherosclerosis in the arteries connecting it to other parts of the body would affect the blood pressure and flow rate the most. As the water was circulated through the system a pressure meter recorded the pressure of the water exiting the tube. The water exiting the tube per minute was recorded from the reading on a graduated cylinder. To represent progressive atherosclerosis, four different orifice diameters were used.

Results
The results from the experiment the experiment supported most of what was hypothesized. The mean flow rate (mL/min) was 371±2.33mL/min for the original tubing that represented a normal heart and decreased only about 1.09% to the pinhole diameter opening. The average percent increase for the pressure of water exiting the system from the original diameter to the pinhole diameter was 143%. The results were fairly precise, with an average percent deviation for the flow rate of about 0.454% and an average percent deviation for the pressure to be about 0.480%.

Conclusions/Discussion
The results correlated with background research in the sense that the slow decrease in the flow rate could be supported by the design of peristaltic pump to be similar to way the heart functions. The heart has a strong ability to overcome up to about 40-50% occlusion in the arteries, by enlarging, to pump the same amount of blood. The pressure of someone with progressive atherosclerotic heart disease is on average higher than those with mild to no atherosclerosis.

Summary Statement
A model heart was designed to better understand how progressive atherosclerosis affects the blood pressure and heart rate

Help Received
Mr. Sorenson provided me with equipment to test my experiments