Research Proposal:
Surface Analysis of Used Mechanical Heart Valves for Microcracks and Defects Detection

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August 19, 2023

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1 Introduction

add intro

2 Motivation

Motivated by patient safety and medical innovation, my proposed research on "Surface Analysis of Used Mechanical Heart Valves for Microcracks and Defects Detection" aims to uncover wear mechanisms that compromise valve performance. Rooted in my father's cardiologist expertise, I'm intrigued by the extent of microcracks on used heart valves and the potential link between service life and valve depreciation. This interdisciplinary study merges materials engineering and medical insights, exemplifying collaboration's potency in solving real-world challenges. With practical implications in heart valve design and testing, this research echoes my commitment to advancing medical science through interdisciplinary excellence.

3 Background and Literature Review

Heart Valves

add things here

Related Research

A relatively old research article regarding the surface analysis of used mechanical heart valves is available. This article revolves around a sample size of 17 heart valves. [1]

[2]
[3]
[5]
[4]
[6]
[7]

4 Research Objectives

1. Conduct literature search
2. Acquire sterilized samples
3. Prepare the samples, remove suture rings or any extra components
4. Initial analysis under an optical microscope
5. Cut and polish the samples
6. Analyze under an optical microscope
7. Document findings, collect images
8. Discuss if there is a correlation between the service life and the amount and extent of surface defects on the valves
9. Report findings

5 Sample Collection and Preparation

Two samples have been acquired already. The brand and service life of these samples are summarized in the table below.

Sample	Brand	Material	Service Life
1	Medtronic	Carbon coated titanium	4 days
2	Björk-Shiley	Carbon coated titanium	35 years

Approximately 10 more samples will be acquired. These samples are expected to have service lives distributed evenly in the range from 1 year to 40 years.

6 Timeline and Work Plan

Below is a timeline showing all the past and future milestones of this proposed study.

Progress to be made in 2023:

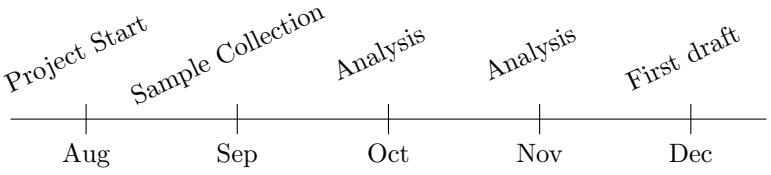

Figure 1: Project Timeline

7 Ethical Considerations

The proposed research does not entail any significant ethical considerations. The focus of the study is solely on the material analysis of used replacement heart valves and these valves are obtained anonymously, without any personal or sensitive data linked to the former owners of these implants. Only medical information related to these implants are the following: the brand and model of the implant, and the time spent in the patient's body. Nonetheless, adherence to scientific integrity will always be a priority throughout the research.

8 Conclusion

This research proposal outlines the plan to study the surface of used mechanical heart valves for defects. Following a timeline, it is aimed to achieve the goals through research, sample collection, and analysis in a systematic manner.

It is aimed to provide insights into heart valve performance, contributing to a better understanding of the incidence of surface defects on mechanical heart valves. This will help with understanding the most defect-prone regions of the heart valves and ultimately suggest possible improvements.

References

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