Temporomandibular Joint (TMJ) Implant Retrieval Study

Maria Alfaro
Shelley Kerwell
Introduction

- Temporomandibular Joint (TMJ)
  - Condyle and fossa
  - Ball and socket joint
  - Mastication, speaking, etc.

- Temporomandibular Joint Disorder (TMD)
  - Headaches, locked jaw and pain, neck pain
  - Affects 10 million Americans [1]
  - End-stage solution is a TMJ TJR

Background

- **TMJ TJR**
  - 1,000-2,000 replacement surgeries/year in the US [2]
  - Implants expected to last 5 years, but replaced in 3 years [3], unlike hip replacement (≈15 years)

-In order to compare failure mechanisms evaluation of all TMJ TJR that have been/currently employed:

MoM, MoP, and TiNi Coated

Image adapted from: www.sherryeudy.com/SherrysTMJSr.html.
Objectives/hypothesis

• **Aim:** Investigate and compare degradation mechanisms of failed metal-on-metal (MoM), metal-on-polymer (MoP), and titanium-nitride coated TMJ TJR implants to control TMJ TJR implants by analyzing alloy microstructure using an established orthopedic TJR device retrieval protocol.
Experimental design

- TMJ Retrieval Implants
- MoM
- MoP
- Titanium Nitride Coated

* Scanning Electron Microscopy
  * Smartscope
  * White Light Interferometry

Surface damage and degradation mechanisms
Materials and methods

TMJ Implant Type

- MoM
  - n = 19
- MoP
  - n = 7
- TiNi coated
  - n = 2
- Control (MoM)
  - n = 3

SEM

SmartScope

WLI
Results

Fig 1. Retrieved MoM Implant A. SEM at 1000X, hard phases evident and pitting; B. SEM at 1000X, pitting corrosion.

Fig 2. Control condyle A. SmartScope image at 95.3X, scratching evident; B. SEM image at 1000X, pitting and hard phases evident source of third body particles; C. WLI, surface roughness of 343.77 nm.
Results

Fig 3. Retrieved Polymer A. SmartScope, 95.3X; B. A gross comparison between retrieved MoM and MoP implants, MoP exhibited a larger surface wear.

Fig 4. TiNi Coated A. SEM at 100X, coated vs. uncoated surfaces seen; B. SEM at 500X, cracking visible in underlying Ti alloy and loss of TiNi coating; C. WLI, surface roughness of 870.12 nm.
Progresses

• Peripheral Tissue Sample Microscopic Images and Composition

• This research is still in progress
  – SEM (retrieved MoM)
  – WLI (retrieved MoM)
Future work

➢ As part of a translational study, a comparison to observations of the HIP system will also be made to this study’s findings.

➢ This study is still in progress, a series of \textit{in-vitro} tests under mechanical loading is under construction.
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