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A Comparison of Onlay vs. Inlay Glenoid Prosthetic Design Survivorship Characteristics in Total Shoulder Arthroplasty

(Manuscript in-review)

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Inlay vs. Onlay: A Comparison of Two Glen

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In collaboration with Clemson University and t

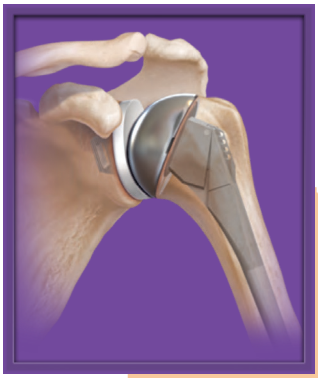
STATEMENT OF PURPOSE

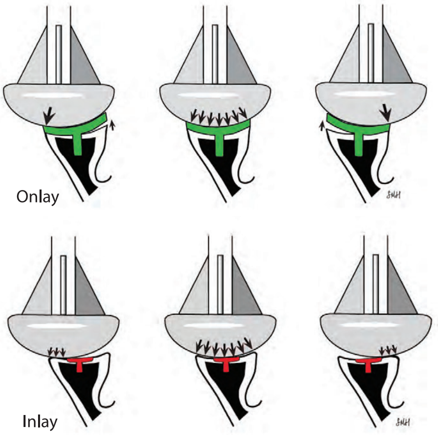
The glenohumeral joint is the most freely moving joint in the body.

The wide range of load and motion induced joint pathology can lead to a Total Shoulder Arthroplasty (TSA):

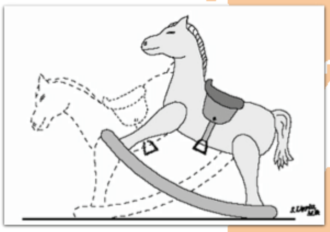
1. Humeral Component
2. Glenoid Component

The purpose is to examine the contact pressures and implant stability associated with fatigue loading of the glenoid inlay and onlay systems during physiologic loading and motion in a cadaveric model.





Hypothesis:
The glenoid inlay system will exhibit lower contact pressures, greater implant stability, and less rocking horse motion following fatigue loading than a standard onlay TSA system.



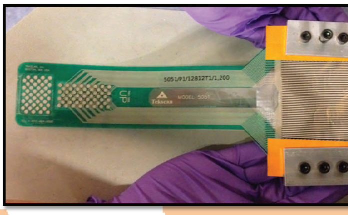
MATERIALS AND METHODS

ONLAY SYSTEM

INLAY SYSTEM

Eight matched pair cadaveric shoulders (n=16) were dissected free of their musculature and each potted in aluminum alloy fixtures.

The glenoid was positioned parallel to the floor, with the humerus secured for testing in an abduction angle of 60°. Biomechanical testing was carried out using a materials testing machine that articulated the humerus with respect to the glenoid.



A flexible force sensor (K-scan Mod
positioned in the glenohumeral j
distributi

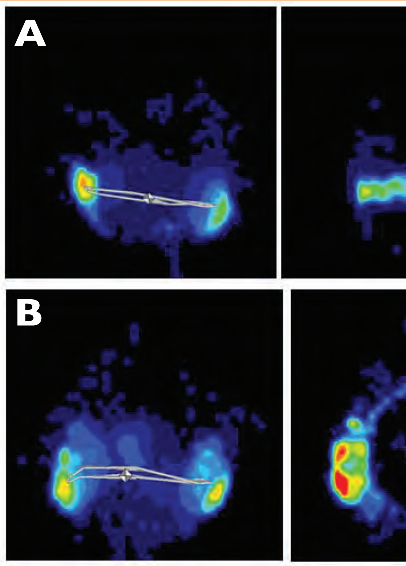
A ± 5 mm displacement-controlled a
induced to produce glenoid edge loa
load was applie

TSAs were then performed on all sho
with one of each matched pair being i
(Turon system - DJO Surgical) and t
(HemiCAP syste

Biomechanical testing was repeated, fo
cyclic fatigue testing with a joint compre
to 4000 cycles or until clinical loosening

Differences in measures of contact a
stability and bone patency were statis
and over fatig

RESULTS ar



A: Specimen tracking shown pre-implantati
pre-fatigue testing (middle), and post-implan
B: Specimen tracking shown pre-implantatio
pre-fatigue testing (middle), and post-implan

ACKNOWLE

We extend sincere gratitude to all parties involved in making this study a success: Clemson University Bioeng
and the Frank H. Stelling and C. Dayton Riddle C

oid Systems in Total Shoulder Arthroplasty

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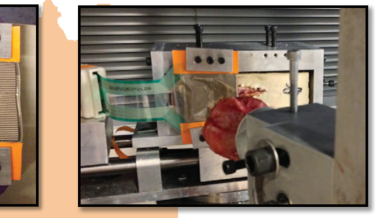
BIOENGINEERING



el 5051, Tekscan, Inc.) was reproducibly oint to record the contact pressure on and area.

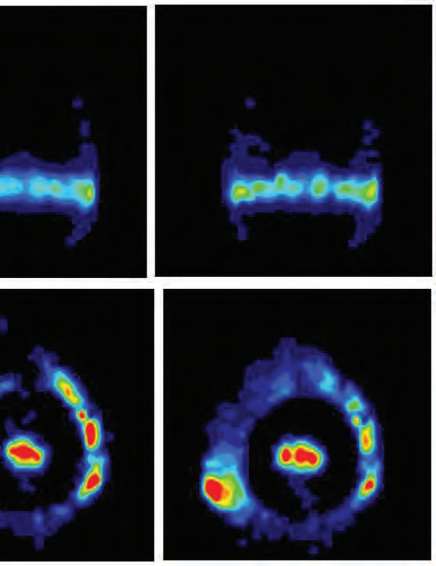
anterior/posterior humeral motion was ading while an 88.9 N compressive joint d across the joint.

ulders followed by post implantation CT, implanted with the onlay glenoid implant he other with the inlay glenoid implant em - Arthrosurface).

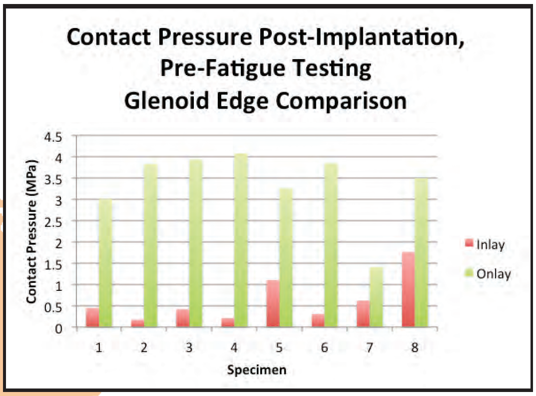
ollowed by ± 5 mm of anterior/posterior essive load of 333.6 N. This was performed was observed, followed by a final CT image.

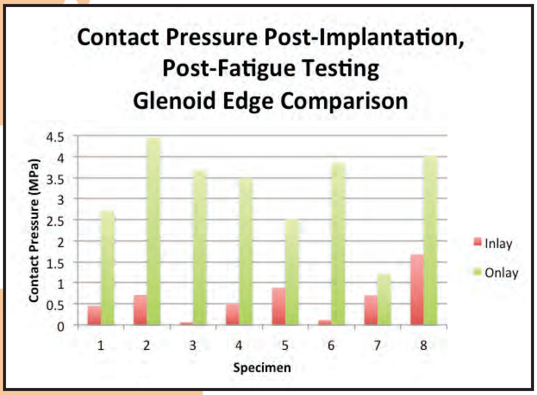
rea, center of pressures, clinical implant tically assessed between implant designs gue testing time.

nd DISCUSSION



on (left), post-implantation of an onlay implant, ntation post-fatigue testing (right)
on (left), post-implantation of an inlay implant, ntation post-fatigue testing (right)





The specimens implanted with onlay implants experienced much higher pressures on the edge of the glenoid.

These pressures were diverted to a more central location and native tissue experienced most of the edge loading with the inlay implant.

This is a potential explanation for the dramatic difference in visible loosening seen during fatigue testing, as shown in the chart below.

Each specimen implanted with an onlay implant experienced visible loosening in less than half the cycles that the inlay experienced without any signs of loosening.

Specimen	1	2	3	4	5	6	7	8
Onlay	875	1372	1463	772	1838	n/a**	814	749
Inlay	4000*	4000*	4000*	4000*	4000*	4000*	4000*	4000*

*Specimen was fatigued 4000 cycles and did not loosen, however testing was stopped.

CONCLUSIONS

The inlay implant resisted visible loosening in all fatigue testing of 4000 cycles, however all onlays showed loosening in under 2000 cycles

The pressure was higher on both implants (polyethylene) than the native tissue

The change in location of pressure during eccentric loading to a more central area provided better stability to the inlay because the pressure was diverted to the native tissue on the glenoid edge

REFERENCES

Matsen FA 3rd, Lippitt SB. Shoulder surgery: principles and procedures. Philadelphia: Saunders; 2004. Principles of glenoid arthroplasty; p 508.

EDGMENTS

ineering Department, Steadman Hawkins Clinic of the Carolinas, DonJoy Orthopaedics, Arthrosurface, Inc., Orthopaedic Education and Research Laboratory.

Study performed in collaboration with Clemson University and
The Steadman Hawkins Clinic of the Carolinas

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