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Effect of Optimizing Bone-Implant Contact on Hip Offset and Anteversion with Three Contemporary Uncemented Short Metaphyseal-Engaging Implants.

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Disclosure

In Accordance with ACGME guidelines the author (SDS) acknowledges there is a financial relationship with Industry.

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FDA status: All Devices Cleared

Introduction

- The goal of THA is to achieve long-term fixation and optimize hip kinematics by restoring offset and anteversion.
- Implant position and design play a major role in the extent of femoral contact and the resulting offset and anteversion.
- Hip instability and dislocation, both affected by implant offset and anteversion, continue to be a concern.

Objective

To analyze the resulting offset and anteversion of three short metaphyseal-engaging femoral implants after virtual placement with optimum bone-implant contact.

Methods and Materials

– 3 Proximally engaging stems

- **Tri-LOCK** (DePuy Orthopaedics, Warsaw, IN)
 - Tapered straight stem
- **ABG II** (Stryker, Mahwah, NJ)
 - Anatomical
- **ARC** (Omnilife Science, East Taunton, MA)
 - Femoral neck preserving

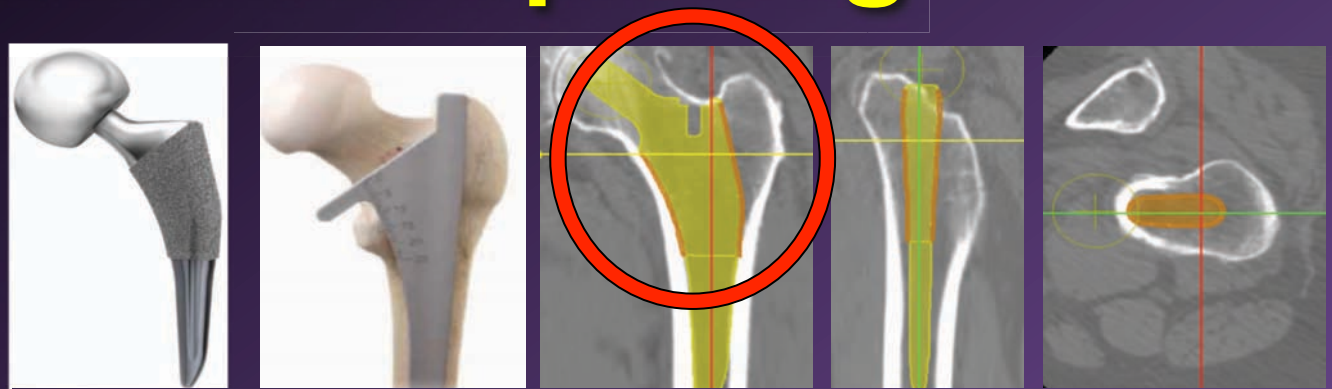


- Computer assisted CT-templating program - ORTHODOC (ISS Inc, Davis, CA)

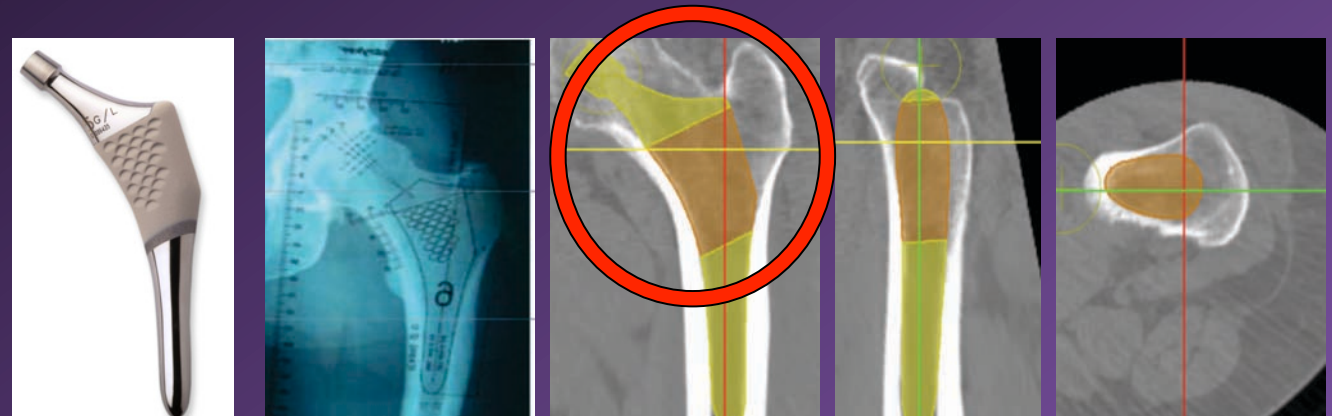
- CT's of 30 patients were each templated with all three stems
 - » 15 right femurs
 - » 15 left femurs
- Total of 90 templates

Virtual Templating

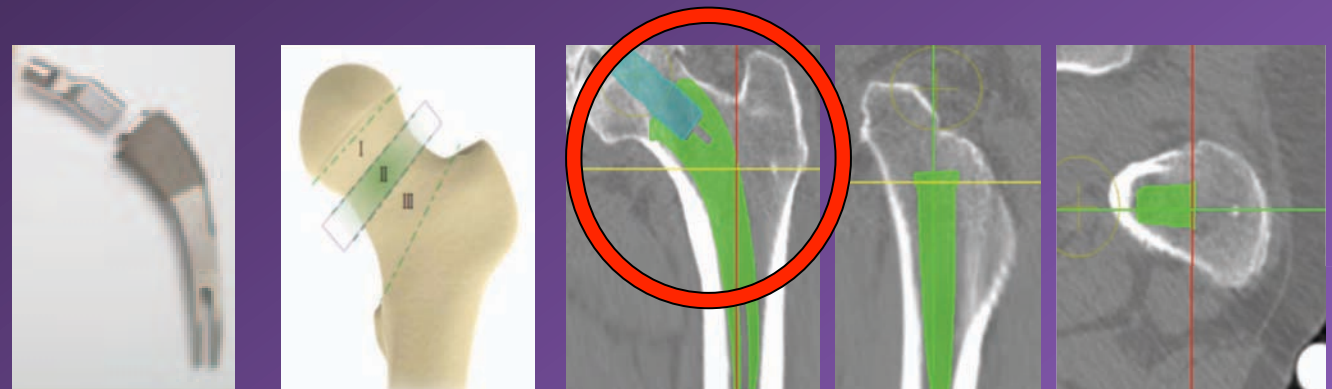
Tri-Lock



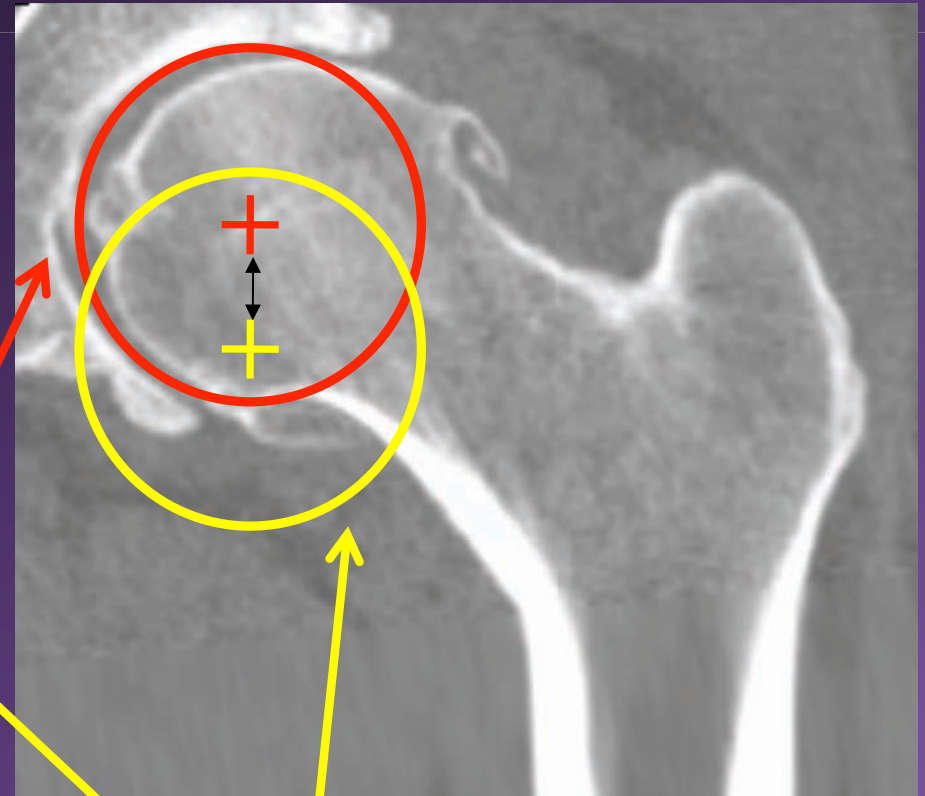
ABG II



ARC



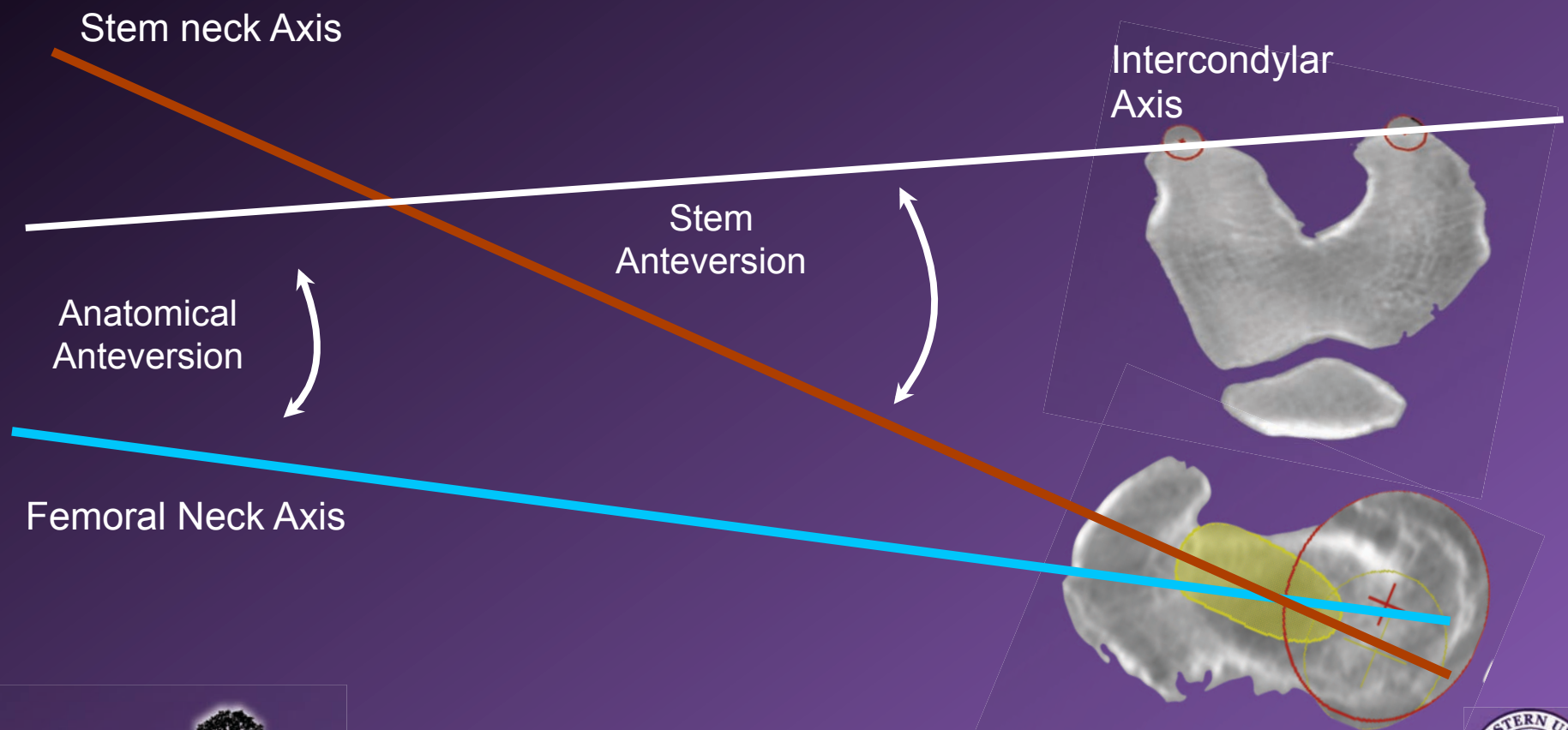
Measuring Offset



Native Femoral
Head Center

Post-Template
Implant Head Center

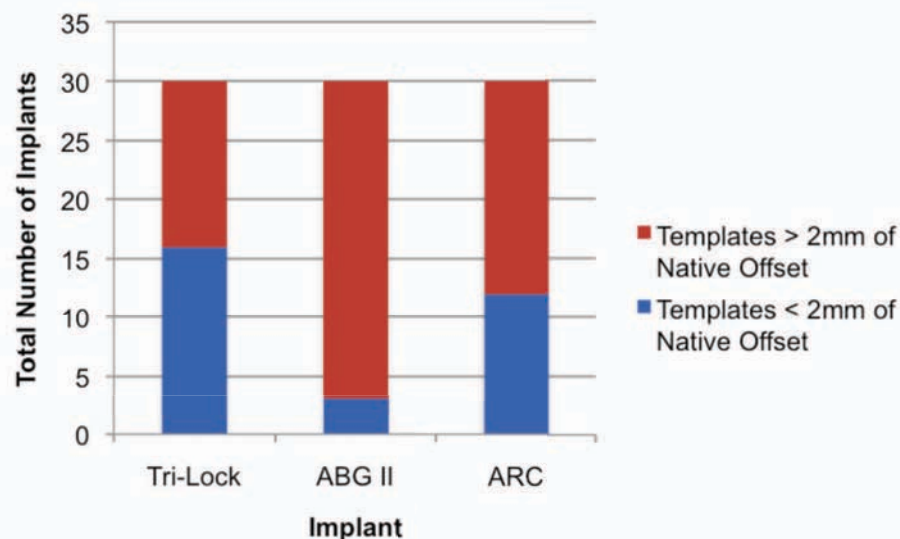
Measuring Femoral Neck and Implant Anteversion



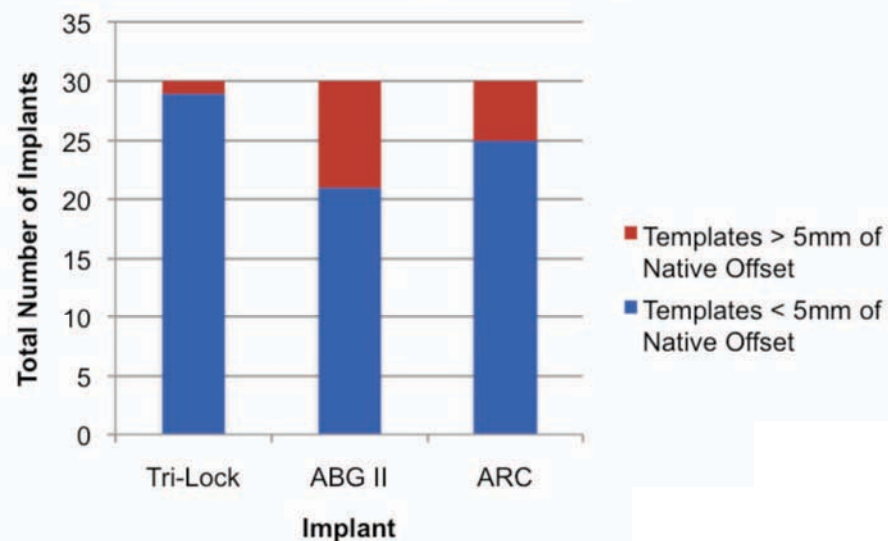
Results - Offset

Stem	Offset \pm 2mm	Offset \pm 3mm	Offset \pm 5mm
Tri-Lock	53.3%(16/30)	73.3% (22/30)	96.7% (29/30)
ABG II	10% (3/30)	26.7% (8/30)	70% (21/30)
ARC	40% (12/30)	63.3% (19/30)	83.3% (25/30)

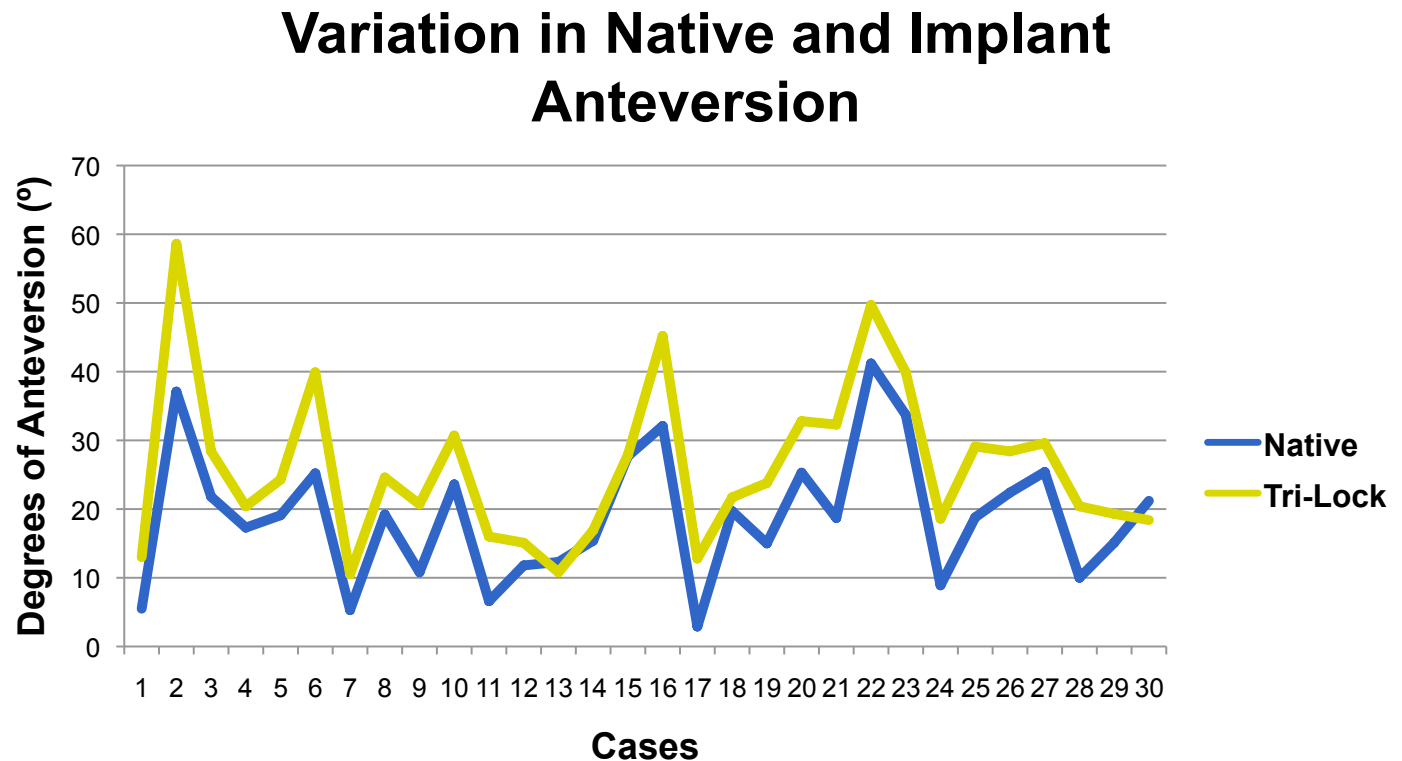
Virtually Templated Implants Compared to Native Femoral Offset (\pm 2mm)



Virtually Templated Implants Compared to Native Femoral Offset (\pm 5mm)



Results - Tri-Lock Anteversion



Stem
Anteversion

25.6°
(10.5°-49.7°)

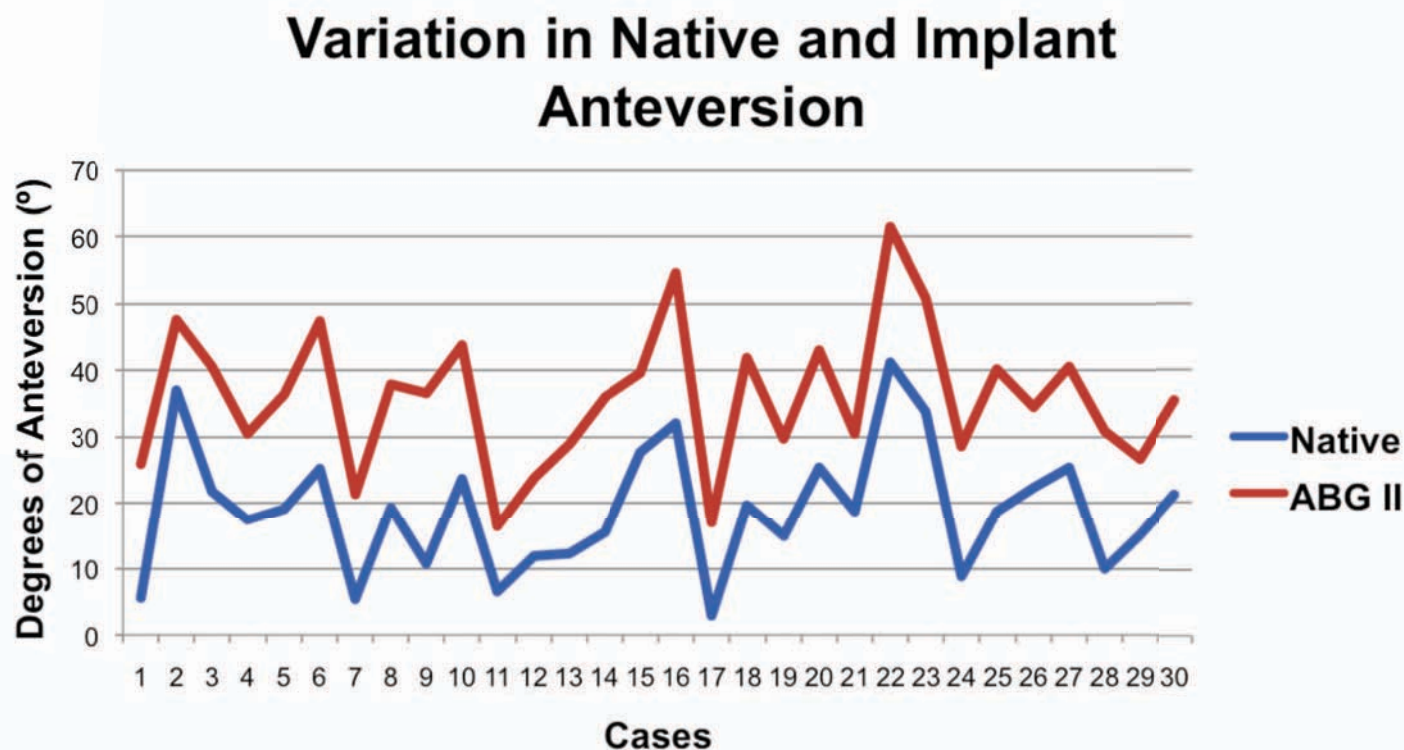
Patient Native
Anteversion

16.8° (-4.4°-41.2°)

Difference

8.8 (-2.6-19.6°)

Results - ABG II Anteversion



Stem
Anteversion

35.8°
(16.4°-61.5°)

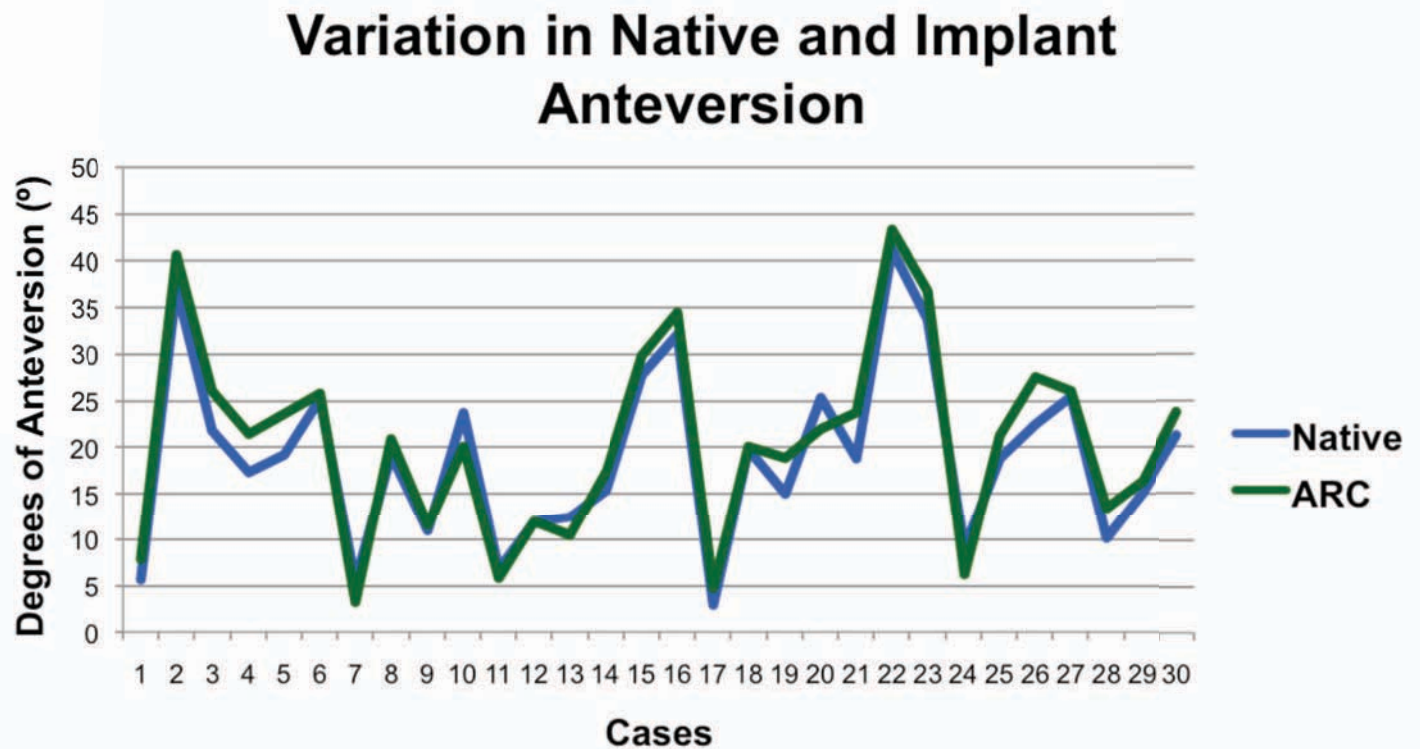
Patient Native
Anteversion

16.8° (-4.4°-41.2°)

Difference

19.01°
(11.6° - 31.3°)

Results - ARC Anteverision



Stem
Anteverision

20.4°
(3.2°-43.3°)

Patient Native
Anteverision

16.8° (-4.4°-41.2°)

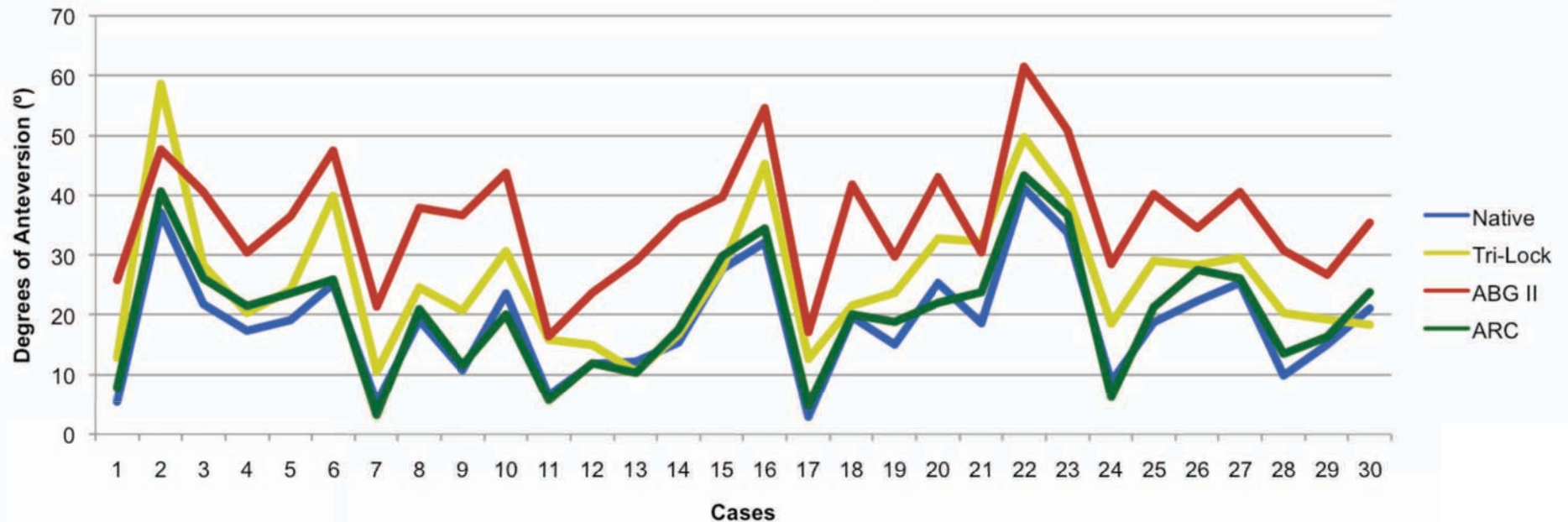
Difference

3.6°
(-3.4° - 16.3°)

Results - Anteversion

Stem	Stem Anteversion	Patient Native Anteversion	Difference
Tri-Lock	25.6° (10.5°-49.7°)	16.8° (-4.4°-41.2°)	8.8 (-2.6-19.6°)
ABG II	35.8° (16.4°-61.5°)		19.01° (11.6° - 31.3°)
ARC	20.4° (3.2°-43.3°)		3.6° (-3.4° - 16.3°)

Variation in Native and Implant Anteversion



Conclusions

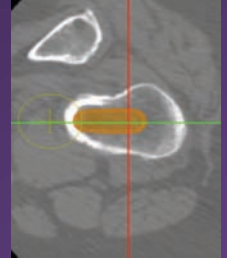
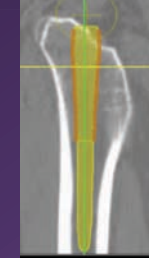
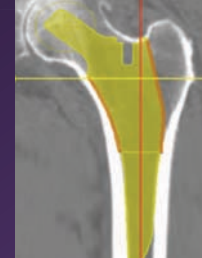
- Tri-Lock: Most reliable at restoring native offset within 5mm and less reliable (average $<10^{\circ}$ difference) at restoring native anteversion.
- ABG II: Good reliability at restoring native offset within 5mm but least reliable at restoring native anteversion (Avg 19.01°).
- ARC: Good reliability at restoring offset within 5mm and most reliable at restoring anteversion (3.6°).

Clinical Relevance

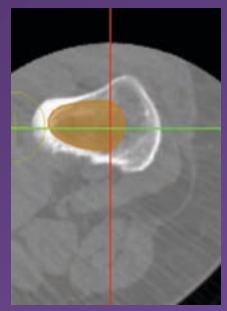
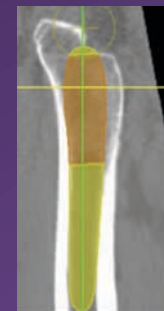
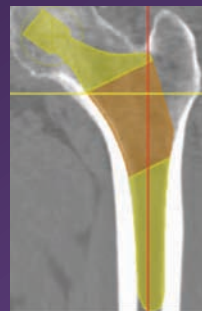
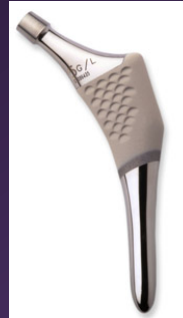
- Stems that establish incomplete metaphyseal implant-bone contact (Tri-Lock) allow for intramedullary adjustment of positioning which may allow restoration of anteversion and offset.
- Stems with more extensive circumferential metaphyseal implant-bone contact (ABGII) may have limited ability to restore anteversion and offset.
- Stems that achieve contact at the femoral neck follow the native anatomy (ARC).

Clinical Relevance

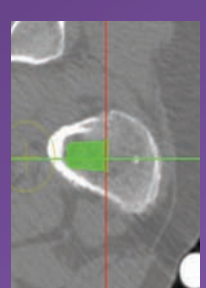
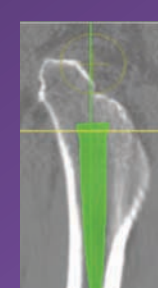
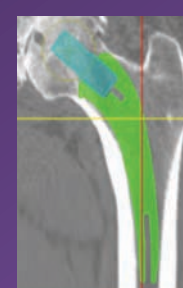
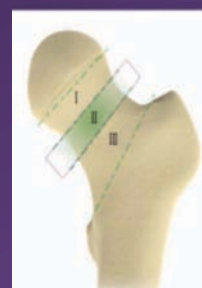
Tri-Lock



ABG II



ARC



Stem designs must aim to incorporate the features necessary to guarantee initial stable and durable long-term fixation while restoration anteversion and offset.

Thank You!



Chicago, IL, USA

Canaima National Park, Venezuela

