MOBILE BEARING HIP SYSTEM

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ADM® X3®

MDM® X3®

System Overview

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Objectives

After this lesson you should be able to:

- Explain to a customer the concept of Mobile Bearing Hips
- Understand the need for Mobile Bearing Hips in the marketplace
- Successfully name the features and the potential benefits of both the ADM and MDM

Agenda

- The Dual Mobility Principle
- Why is there a Need for Mobile Bearing Hips?
- ADM
- MDM

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THE DUAL MOBILITY PRINCIPLE

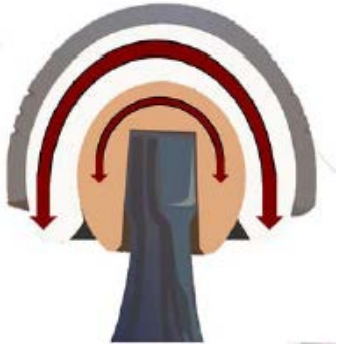
The dual articulation system was based on the foundation of two orthopaedic concepts relating to Total Hip Arthroplasty. The following concepts are well-known and studied in the field.

1. Low Friction Arthroplasty (LFA)- **Charnley** [4,5]

2. Large Head Concept- **McKee Farrar** [4]

Image is clip art

The initial dual articulation system was invented by Professor Bousquet at University Hospital of St Etinenne, France, in 1976. [4]



His design was a *marriage* of the two well-known principles of:

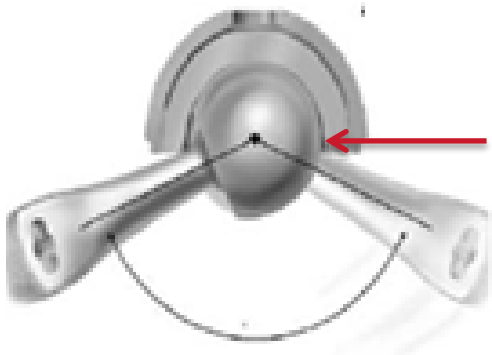
1) Low Friction Arthroplasty [4,5]

2) Large Head Concept. [4]

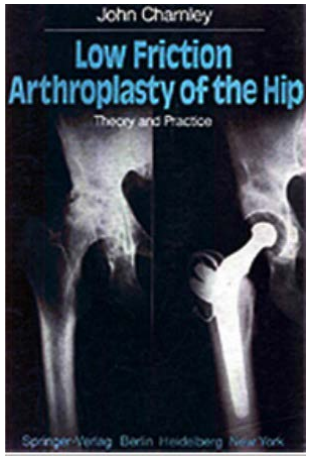
Low Friction Arthroplasty

The Charnley Low Friction Arthroplasy (LFA) prosthesis has demonstrated both clinically and radiologically, that smaller diameter heads produce lower torque forces in the shell and consequently less wear. [4,5]

Small Heads:
Less sliding distance typically leads to **less wear** [4,5]



Inner head =
femoral head



Sir John Charnley

Large Head Concept:

Second, the large head concept from Mckee-Farrar recognizes that a large diameter bearing is inherently more stable than a smaller diameter head [4]

Big Heads: (greater than 36mm)

- Range of motion [10]
- Stability [10]
- Surgeon Security
    - Cup position
    - Revision THA
    - Older and noncompliant patients

McKee Farrar

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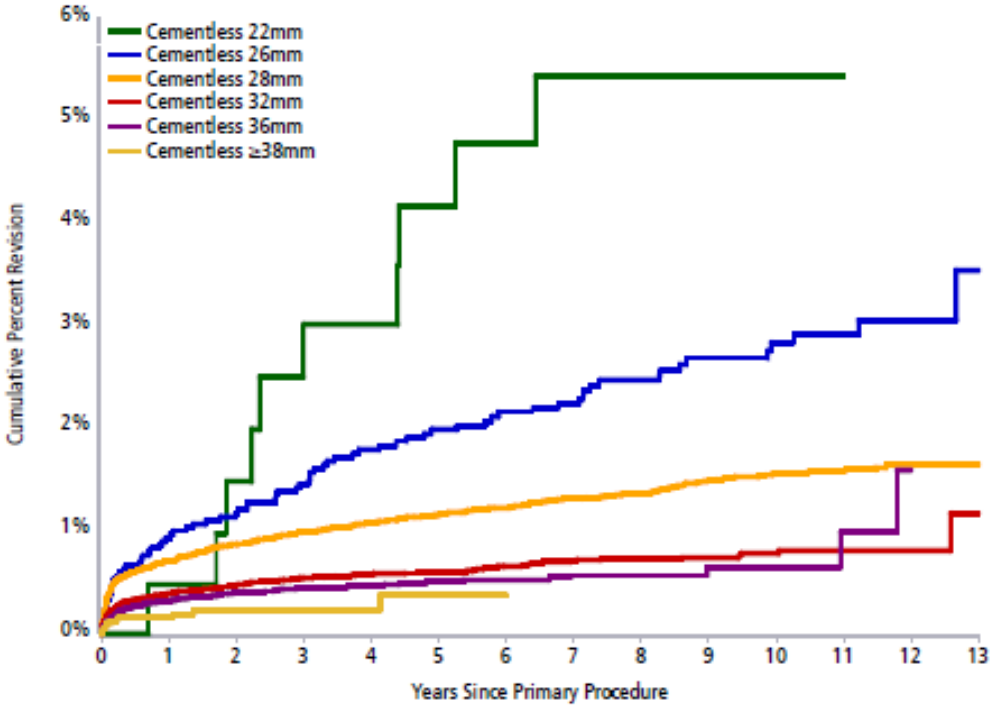
2014 Australian Joint Registry Significance of Larger Heads [8]

Figure D11: Cumulative Percent Revision for Dislocation of Primary Total Conventional Hip Replacement with Cementless Fixation by Head Size (Primary Diagnosis OA)



HR - adjusted for age and gender

Cementless 22mm vs Cementless 32mm

0 - 1.5Yr: HR=1.12 (0.16, 8.00),p=0.908

1.5Yr+: HR=14.32 (7.30, 28.07),p<0.001

Cementless 26mm vs Cementless 32mm

0 - 3Mth: HR=2.07 (1.26, 3.39),p=0.004

3Mth+: HR=4.30 (3.23, 5.74),p<0.001

Cementless 28mm vs Cementless 32mm

Entire Period: HR=1.87 (1.61, 2.18),p<0.001

Cementless 36mm vs Cementless 32mm

0 - 2Wk: HR=0.66 (0.43, 1.02),p=0.062

2Wk+: HR=0.89 (0.73, 1.08),p=0.233

Cementless ≥38mm vs Cementless 32mm

Entire Period: HR=0.52 (0.30, 0.90),p=0.020

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WHY IS THERE A NEED FOR MOBILE BEARING HIPS?

AAOS 2013: WORLDWIDE PERSPECTIVE ON HIP INSTABILITY AFTER THA CURRENT INCIDENCE AND NATURAL HISTORY [15]

Incidence of THA Instability

Dislocation rates after primary THA
- Varied rates reported, 0.3-10%
- Woo and Morrey (1982), 3.2%
- Incidence is highest in the first year with 1% increase/5 years for an approximate 7% risk by 25 years.

Recurrent dislocation (2 or more episodes of dislocation)
- Occurs in 10-60% of patients with first time dislocation

Risk factors for dislocation
- Patient-specific
- Surgical technique
- Surgeon
- Implant design
- Soft tissue integrity

"Specifically, hip instability continues to be problematic in a small subgroup of patients, and efforts are ongoing to further reduce the risk of THA dislocation."

John C. Clohisy, M.D., Daniel C. and Betty B. Viehmann
Washington University School of Medicine, St. Louis, MO

The Epidemiology of Revision Total Hip Arthroplasty in the United States [9]

Kevin J. Bozic, Steven M. Kurtz, Edmund Lau, Kevin Ong, Thomas P. Vail and Daniel J. Berry
J Bone Joint Surg Am. 2009;91:128-133. doi:10.2106/JBJS.H.00155

- Most common cause of revision THA was instability/dislocation (22.5%), followed by mechanical loosening (19.7%), and infection (14.8%).

- Average length of hospital stay: 6.2 days (5.0- 11.8 days). Average billed charges for revision THA procedures: $54,553

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STRYKER'S SOLUTION:

ADM & MDM

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Stryker's Dual Mobility products

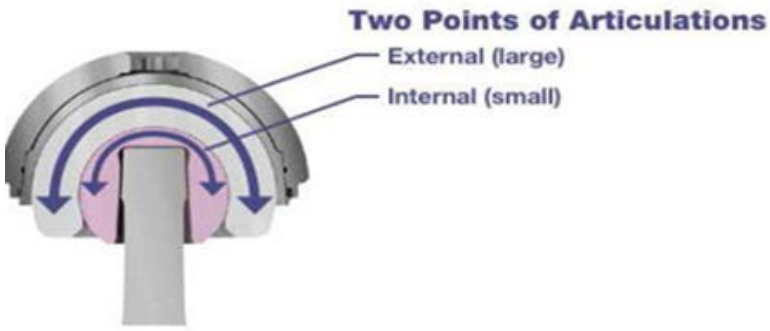
ADM® X3®

- ☑ Stability[1]
- ☑ Longevity[2,3]
- ☑ Anatomic Rim

MDM® X3®

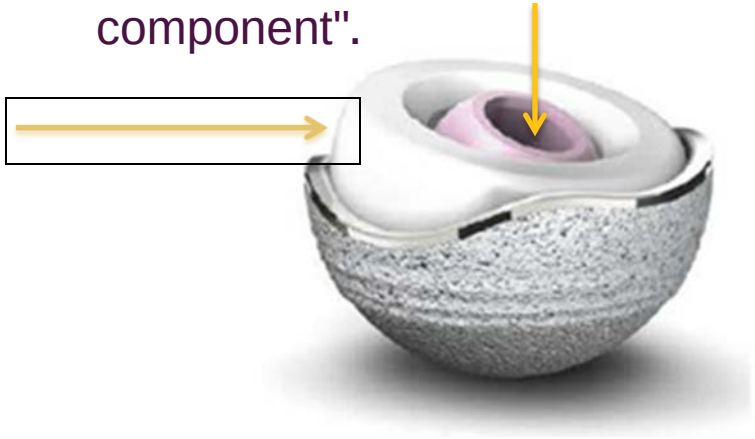
- ☑ Stability[1]
- ☑ Longevity[2,3]
- ☑ Advanced Fixation

The ADM and MDM designs are dual mobility bearings with two points of articulation.



The External Bearing Articulation: refers to the inside of the acetabular cup and the polyethylene insert, also known as the "Effective Head." Helpful Hint: Bench top testing of dual mobility system demonstrated that the torque force required to move the Effective Head only occurred in certain degrees of motion. For example getting out of a chair, waking up stairs, getting off the toilet (Test Report 06-078 reference)

The Internal Bearing Articulation: The Internal Bearing Articulation: refers to the Effective Head, inner surface of the acetabular liner, and the outer surface of the inner bearing, otherwise know as the femoral head component".



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ADM X3

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Anatomic Dual Mobility

World Wide Launch in 2010

- The ADM cup is a monoblock cobalt chrome alloy cup with plasma sprayed titanium surface overlaid with hydroxyapatite.
- This cup has a peripheral self-locking (PSL) 1.5mm press-fit
- The left and right ADM cups incorporate psoas cutouts designed to allow for relief between the acetabular shell rim and iliopsoas tendon.

ADM

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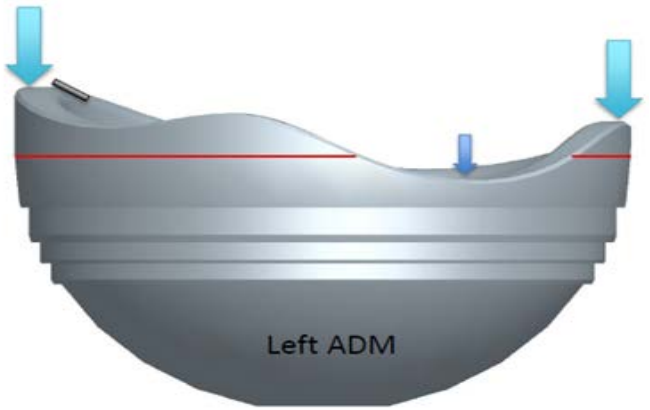
Feature

- **Anatomic Design: is more than a hemisphere, providing more than 180° of coverage (in some areas)**
- **Large Head Technology**



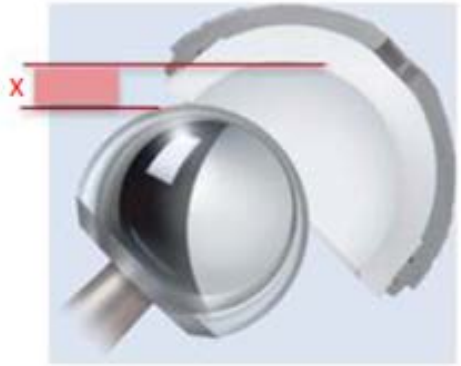
Benefit

- ***STABILITY*** - Offers more than 2 times greater jump distance than competitive hemispherical designs with large head bearings [7] which may allow for improved stability. [7]

Helpful Hint: There are left and right cup shapes. The anatomic rim is greater than a hemisphere is some areas, and smaller in areas where noted by “valleys” for specific anatomic purposes.

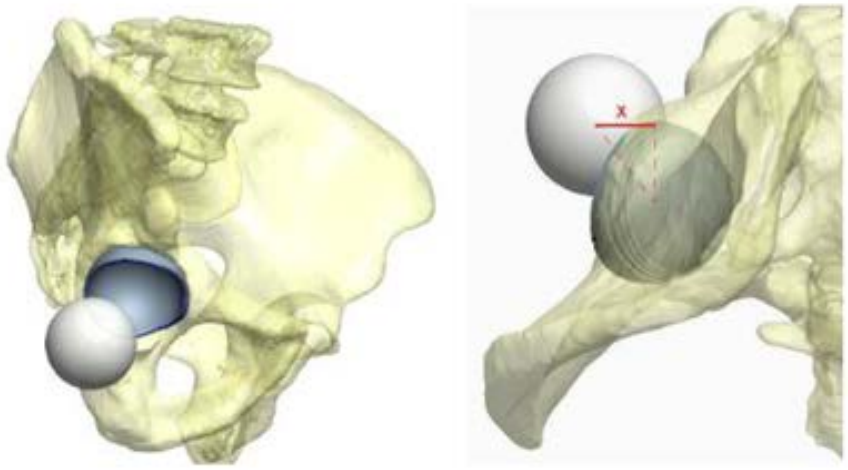
Review: **What is Jump Distance?**

The vertical distance the femoral head must travel before dislocating.



2D Jump Distance with the cup at 45° inclination

Reference: iZine Charts



3D Posterior Horizontal Dislocation Distance (PHDD) at 45° of inclination

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Feature:

- **X3 precisely engineered polyethylene**

Benefit:

- ***LONGEVITY***-Designed to help minimize the risk of wear and consequently help prolong the life of the implant[8]

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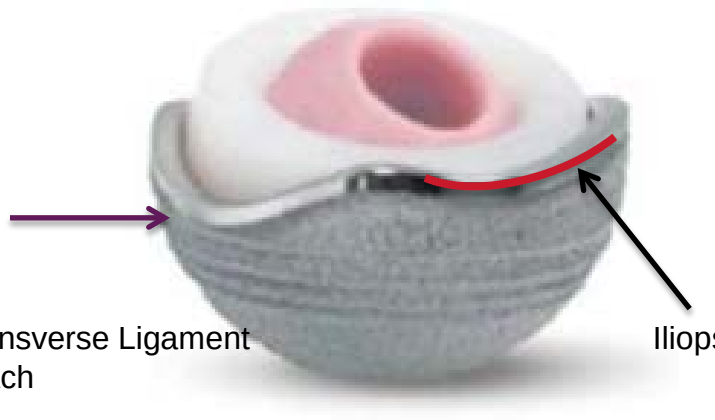
Feature

Iliopsoas & Transverse Ligament Notch



Benefit

ANATOMIC-

- ADM was designed with left and right anatomical cup shapes incorporating a psoas cutout to allow for relief between the acetabular shell rim and iliopsoas tendon.
- Transverse Notch-where the cup is less than a hemisphere may allow for enhanced range of motion [11]

40% of patients are at risk for psoas conflict

Data contained through an anatomical cadaver study [11]

ADM SIZE CHARTS

ADM Cup (OD/mm)	ADM Insert (OD/mm)	Insert Thickness (mm)	Head Diameter (mm)*
46**	40**	5.9	28
48	42	6.9	28
50	44	7.9	28
52	46	8.9	28
54	48	9.9	28
56	50	10.9	28
58	52	11.9	28
60	54	12.9	28
62	56	13.9	28
64	58	14.9	28

What is the difference in the OD ADM cup and the OD of the ADM insert? (OD=outer diameter)

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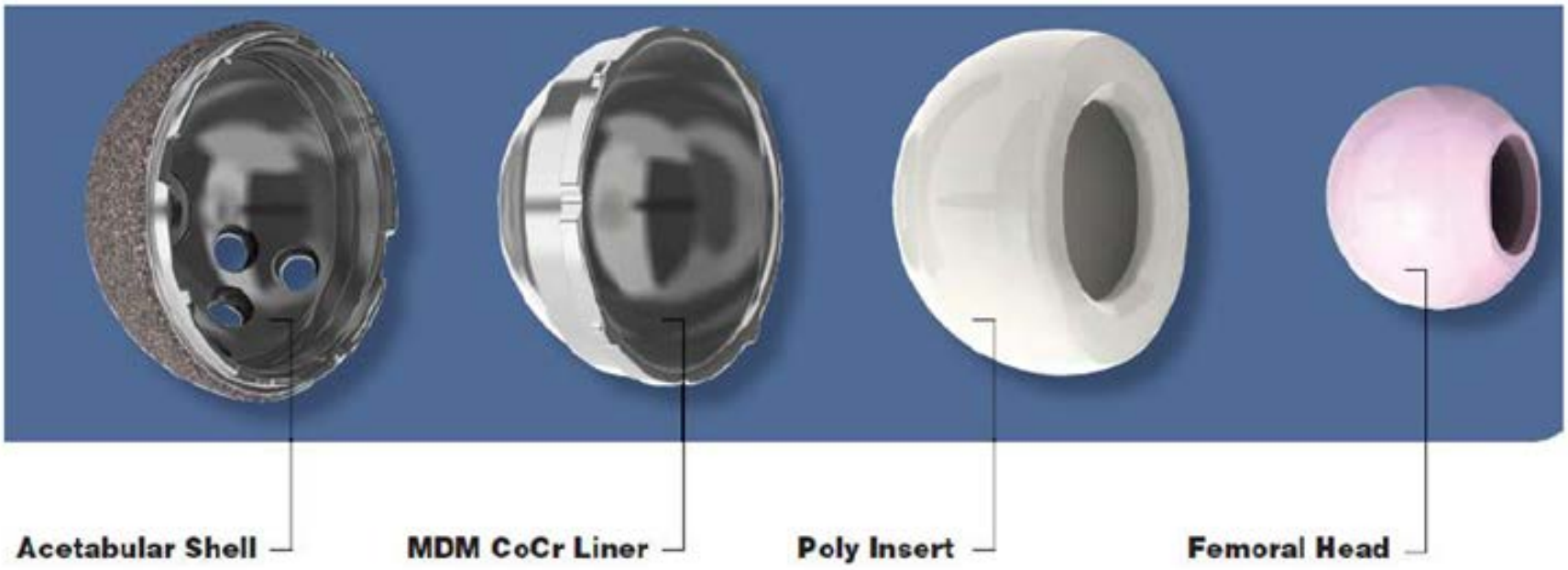
MDM® X3®

World Wide Launch in 2011

Modular Dual Mobility

- MDM is designed for fractures, primary, or revision cases to allow your surgeons to achieve their operative goals of Stability[1], Longevity[2,3], and Advanced Fixation.
- The MDM liner is a smooth cobalt chrome liner utilizing Stryker's Innerchange locking mechanism.
- The MDM liner is compatible with all Trident and Tritanium acetabular shell, giving your surgeons their choice of fixation surfaces and screw hole configuration.

The MDM construct contains 4 parts:



- Acetabular Shell:
  - Trident and Tritanium acetabular systems provide surgeons with versatile options to address a broad range of patient populations.
- MDM CoCr Liner
  - Utilizes Stryker's Trident Innerchange locking mechanism that is designed to minimize motion at the taper interface
- Poly Insert
  - Large diameter X3 effective heads which may allow for improved stability [13]. A 46mm insert OD head is achievable starting in a 54mm shell. *See Table 1 on Slide 29
- Femoral Head
  - Compatibility with Stryker 22.2mm (LFIT) and 28mm LFIT and BIOLOX delta heads.

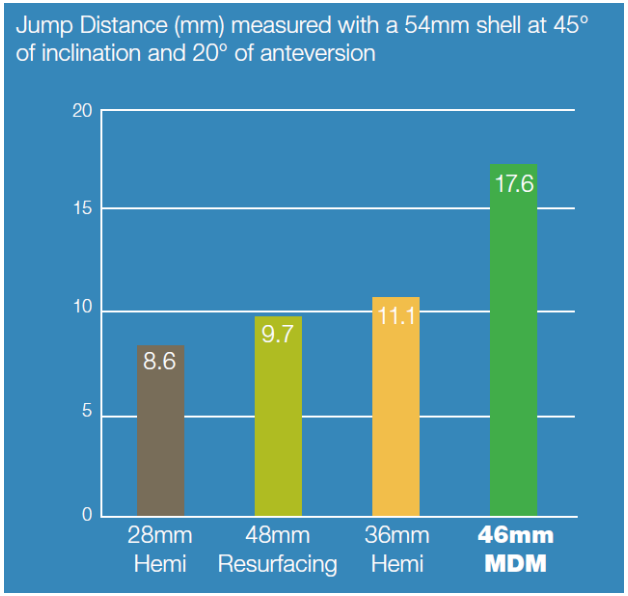
MDM

Feature:

Large Head Technology Design

Benefit:

STABILITY- 59% greater jump height with MDM compared to a conventional THA with a 36mm head [14]



* Although resurfacing type shells have lower jump heights, they have the greatest ROM which is needed when the native femoral neck is retained.

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Feature

X3 Precisely Engineered Polyethylene

Benefit

- ***LONGEVITY*** - Designed to minimize the risk of wear and consequently help prolong the life of the implant [2,3,8]

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Feature

- Versatility of using any Trident or Tritanium Shell with the MDM liner.

Benefit

- *ADVANCED FIXATION-* Compatibility with the Trident Acetabular shell devices offers the option to use cancellous bones screws. Unlike other three dimensional fixation offerings composed of metal alloys, Tritanium is manufactured from CPTi matrix. [16]
- Screw configurations remain the same on the shells

OR Notes

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TABLE 1: MDM Liner and Insert Compatibility with Trident and Tritanium Shells

	SHELL SIZE (mm), LINER ALPHA CODE							
Trident PSL Shell	44	46, 48	50, 52	54, 56	58, 60	62, 64	66, 68	70, 72
Trident Hemispherical Shell	46	48, 50	52, 54	56, 58	60, 62	64, 66	68, 70	72, 74
Tritanium Hemispherical Shell	48	50, 52	54, 56	58, 60	62, 64	66, 68	70, 72	74-80
Liner Alpha Code	C	D	E	F	G	H	I	J
MDM CoCr Liner	36C	38D	42E	46F	48G	52H	54I	58J
Poly Insert OD (mm)	36	38	42	46	48	52	54	58
Poly Insert ID (mm)	22.2	22.2	28	28	28	28	28	28
Nominal Poly Thickness (mm)	6.7	7.7	6.8	8.8	9.8	11.8	12.8	14.8

NOTE: The MDM effective head size offerings range from 36mm-58mm to accommodate primary and revision cases. You can get to a size 36mm head with just a 44, 46, or 48 cup-and still maintain 6mm of poly!

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Sales Practice:

“What does a mobile bearing hip mean?”

Write out a “Talk Track” of how you would respond to a surgeon on what a mobile bearing hip means?

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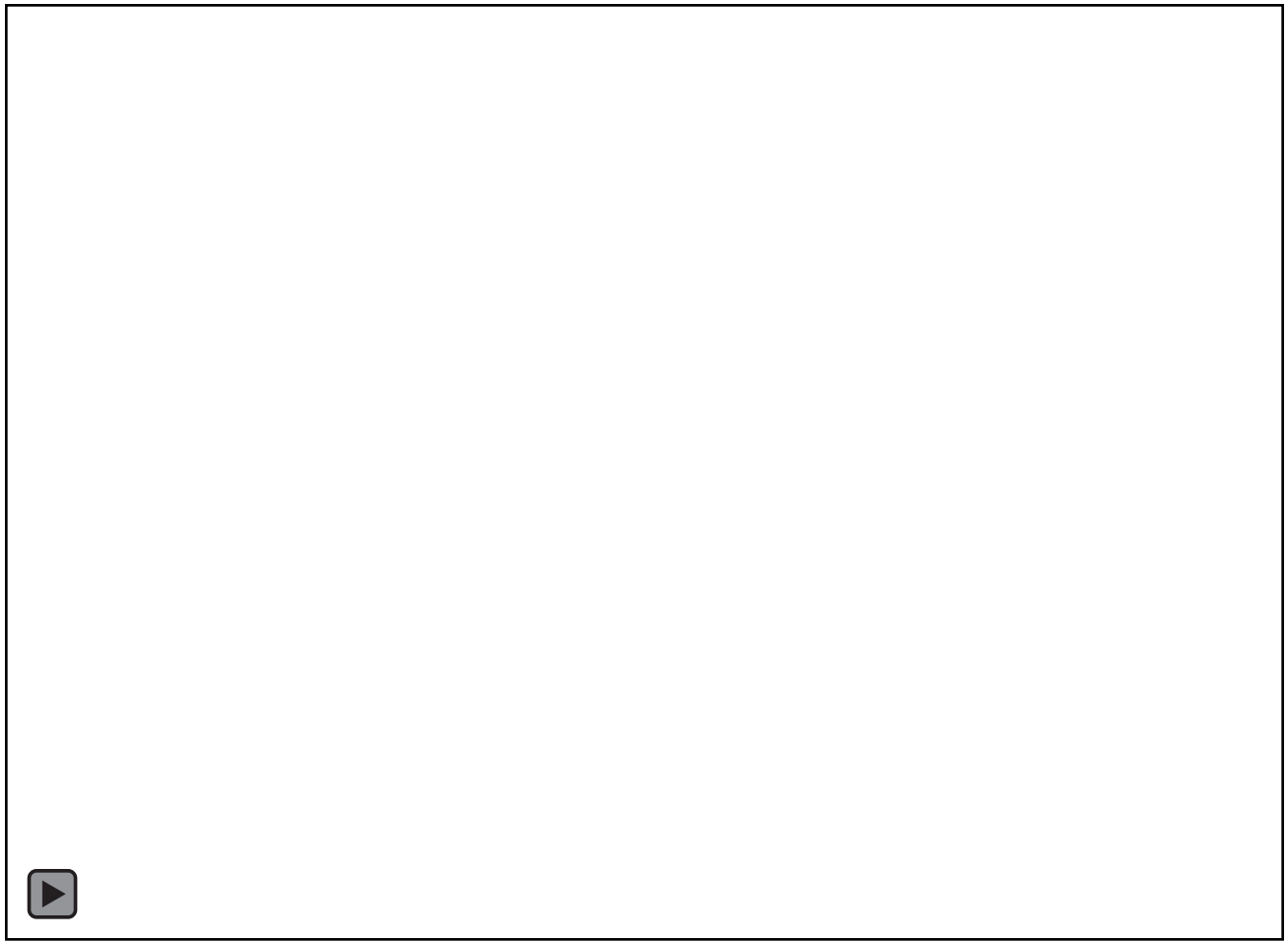

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Talk Track:

ADM and MDM products contain dual mobility bearings with two points of articulation. They are based on the foundation of marrying the two well-known orthopaedic concepts of low friction arthroplasty and large head technology. They were each designed to maximize stability and longevity. With the ADM design, you get the iliopsoas cut-out to allow for relief for the iliopsoas tendon. With the MDM liner, you have the option to use screws to achieve advanced fixation.

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Summary

After this lesson you should now be able to:

- Explain to a customer the concept of Mobile Bearing Hips:
  - The marriage of Low Friction Arthroplasty and Large Head Technology with two points of articulation.
- Understand the need for Mobile Bearing Hips in the marketplace
  - Many patients are at risk for dislocation
  - Dislocation is the second highest reason for revision in THA[9]
- Successfully name the features and the benefits of both the ADM and MDM
  - Stability [1]
  - Longevity [2,3]
  - Anatomic Rim (ADM)
  - Advanced Fixation (MDM)

1. Heffernan, C. , Bhimji, S., Macintyre, J., et al. (2011). Development and Validation of a Novel Modular Dual Mobility Hip Bearing. ORS Annual Meeting Poster #1165.

2. Herrera, L., Lee, R., Longaray, J., et al. (2010). Edge Loading Wear due to Inclination Angle for Three Contemporary Hip Bearings. 56th Annual ORS Meeting. Poster #2259.

3. Stryker Orthopaedics Restoration® ADMX3® 28mm ID acetabular inserts made of X3® Gas Plasma Sterilized UHMWPE, show a 97% reduction in volumetric wear rate versus 28 mm ID Restoration® ADM Duration Gamma Radiation Sterilized UHMWPE. Both ADM constructs utilized a 54mm OD shell and the inserts were approximately 9.9mm thick. Testing was conducted under multi-axial hip joint simulation for 5 million cycles using a 28mm CoCr modular femoral head articulating counterface and calf serum lubricant. Volumetric wear rates were 109.7±6.0 mm^3/106 cycles and -1.03 ± 3.8 mm^3/106 cycles for Duration and X3® polyethylene insert test samples. Although in-vitro hip wear simulation methods have not been shown to quantitatively predict clinical wear performance, the current model has been able to reproduce correct wear resistance rankings for some materials with documented clinical results.1-3

1) Wang, A, et. al., Tribology International, Vol. 31, No. 1-3: 17-33, 1998.
2) Essner, A. et. al., 44th Annual Meeting, ORS, New Orleans, Mar. 16-19, 1998: 774.
3) Essner, A. et. al., 47th Annual Meeting, ORS, San Francisco, Feb. 25-28,2001:1007.

4. Philippot, R., Camilleri, J. P., Boyr, B., et al. (2009). The Use of a Dual Articulation Acetabular Cup System to Prevent Dislocation After Primary Total Hip Arthroplasty: Analysis of 384 Cases at a Mean Following-Up of 15 Years. SICOT 33: 927-932.

5. Wroblewski, B., Siney, P., Flemin, P. (2009). The Principle of Low Friction Torque in the Charnley Total Hip Replacement. JBJS (Br) Vol. 91-B(7): 855-858.

6. Vasukutty, N, Middleton, R, Matthews, E, et al. (2012). The double-mobility acetabular component in revision total hip replacement. *JBJS* Vol. 94-B, No. 5 p: 603-608.

7. Australian Orthopaedic Association 2011 Annual Report. Table HT11: Primary Total Conventional Hip Replacement by Reason for Revision p. 46

8. Australian Orthopaedic Association National Joint Replacement Registry. Annual Report. Adelaide:AOA; 2012

9. Bozic, K, Kurtz, S, Lau, E, et al. (2009). The Epidemiology of Revision Total Hip Arthroplasty in the United States. *JBJS* 91: 128-133.

10. Nevelos, J., Bhimji, S., Macintyre, J., et al. (2010). Acetabular Bearing Design Has a Greater Influence on Jump Distance than Head Size. 56th Annual ORS Meeting: Poster #2028.

11. Tracol, P, Vandenbussche, E, Deloge, N, et at. (2007) Navigation Acetabular Anatomic Study Application in the Development of a New Implant. EFORT Poster.

12. Loving, l, Lee RK, Herrara L, Essner AP, Nevelos JE. Wear performance evaluation of a contemporary dual mobility hip bearing using multiple hip simulator testing conditions. J Arthroplasty. 2013 June; 28(6):1046.

13. Heffernan C, Macintyre J, Markel, D, Mont, M. The influence of Dual Mobility Cup Design on Posterior Horizontal Dislocation Distance in Common Sizes of THA. ORS Poster, 2012.

14. Stryker Test Report Rd-10-073

15. Clohisy, John M.D., Veihmann, Daniel and Betty. AAOS 2013 World Wide Perspective on Hip Instability After THA Current Incidence and Natural History.

16. Naziri et al. Excellent Results of Primary THA Using Highly Porous Titanium Cup. Orthopaedics. Vol 36, 2013. V