Primary - Left Hip 11/6/2006

DATE | PROGRESS RECORD – CONTINUED

11/6/06 Surgical Implants Left Hip Per Dr. J. Pritchett / C. Davidson

BIOMET ORTHOPEDICS, INC.
REF 402432
LOT 706010
COBALT(TM) HV BONE CEMENT - 40/20
SOFTPAC SYSTEM
PMMA/MMA 1 PACK

EXPIRE DATE: 2007-01

AFFIX TO PATIENT RECORDS

ATTACH TO PATIENT RECORD 2014-09

REF: 3802-4652
LOT 096371769
CONSERVE® PLUS CUP
SHELL SIZE 62mm O.D.
I.D. 46mm MATL: COCR
SURFACE BEADED

WRIGHT Wright Medical Technology, Inc.
5677 Airline Road • Arlington, TN 38002

ATTACH TO PATIENT RECORD 2014-09

REF: 3803-1046
LOT 096377803
CONSERVE® SUPERFINISH
FEMORAL RESURFACING COMPONENT
SIZE OD 46mm
STEM LENGTH 65mm

WRIGHT Wright Medical Technology, Inc.
5677 Airline Road • Arlington, TN 38002

SUMMARY OF SAFETY AND EFFECTIVENESS DATA (SSED)

I. GENERAL INFORMATION

Device Generic Name: Prosthesis, Hip, Semi-constrained, Resurfacing Metal/Metal hybrid fixation

Device Trade Name: CONSERVE® Plus Total Resurfacing Hip System

Applicant's Name and Address: Wright Medical Technology, Inc.
5677 Airline Road
Arlington, TN 38002

Date of Panel Recommendation: None

Premarket Approval Application (PMA) Number: P030042

Date of FDA Notice of Approval: November 3, 2009

Expedited: Granted expedited review status on March 30, 2004 because total hip systems with a resurfacing femoral component and a metal-on-metal articulation may offer advantages in safety and effectiveness over existing alternatives; such as, the preservation of femoral bone stock during implantation as compared to metal-on-metal total hip systems and a decrease in adverse tissue reaction due to particulate wear debris as compared to metal-on-polyethylene resurfacing hip systems.

II. INDICATIONS FOR USE

The CONSERVE® Plus Total Resurfacing Hip System is a single use device intended for hybrid fixation utilizing: cemented femoral head component and cementless acetabular component. The CONSERVE® Plus Total Resurfacing Hip System is intended for use in resurfacing hip arthroplasty for reduction or relief of pain and/or improved hip function in skeletally mature patients having the following conditions:

- Non-inflammatory arthritis (degenerative joint disease) such as osteoarthritis, traumatic arthritis, avascular necrosis, or dysplasia/developmental dislocation of the hip (DDH), or
- Inflammatory arthritis such as rheumatoid arthritis.

The CONSERVE® Plus Total Resurfacing Hip System is intended for patients who, due to their relatively younger age or increased activity level, may not be suitable for traditional total hip arthroplasty due to an increased possibility of requiring future ipsilateral hip joint revision.

The design features of the CONSERVE® Plus Resurfacing Femoral Component are as follows:

- Manufactured from Cast Cobalt Chrome Alloy conforming to ASTM F75[1].
- Offered in a range of outer diameters from 36mm to 54mm in 2mm increments.
- The articulating surface of the implants is superfinished to insure form tolerance and a fine surface finish.
- The undersurface of the femoral component has a "glass-bead" blasted surface finish (125 Ra Max) and contains a shallow circumferential undercut band at the head's equator.
- A tapered stem geometry.

The design features of the CONSERVE® Plus Acetabular Shells are summarized below:

- Manufactured from Cast Cobalt Chrome Alloy conforming to ASTM F75.
- Porous coated with Cobalt Chrome Alloy sintered beads conforming to ASTM F1377.
- The articulating surface of the implants is superfinished to insure form tolerance and a fine surface finish.
- Available Sizes: 36mm ID/46mm OD to 54mm ID/64mm OD in 2mm increments.

Sizing and System Compatibility

The correct selection of the prosthesis is extremely important. The potential for success in total hip resurfacing arthroplasty is increased by selection of the proper size of the prosthesis. Total hip resurfacing prostheses require careful seating and adequate bone support.

The femoral heads are compatible with the following acetabular components:

CONSERVE® Plus Total Resurfacing Hip System Sizing and System Compatibility	
Femoral Component (Nominal Outer Diameter)	Acetabular Component (Nominal Inner Diameter/ Nominal Outer Diameter of shell)
36mm	36mm ID/ 46mm OD
38mm	38mm ID/ 48mm OD
40mm	40mm ID/ 50mm OD
42mm	42mm ID/ 52mm OD
44mm	44mm ID/ 54mm OD
46mm	46mm ID/ 56mm OD
48mm	48mm ID/ 58mm OD
50mm	50mm ID/ 60mm OD
52mm	52mm ID/ 62mm OD
54mm	54mm ID/ 64mm OD

VI. ALTERNATIVE PRACTICES AND PROCEDURES

There are several other alternatives for the reduction or relief of pain and/or improved hip function including:

- Non-surgical treatment (e.g., reduced activity, medications, physical therapy) or no treatment at all;
- Other commercially available total hip replacement devices. Commonly used implant bearing materials for total hip arthroplasty include metal on ultra-high molecular weight polyethylene (UHMWPE), ceramic on UHMWPE, metal on metal, and ceramic on ceramic. Total hip replacement devices are implanted by either cemented or uncemented techniques;

Table 6: Demographic Characteristics and Baseline Function in Pivotal Unilateral Efficacy Cohort (Original Shell) Patients and Unilateral Control Patients

	Pivotal Unilateral Efficacy Cohort (Original Shell) (I)		Ceramic THR Controls (C1)		Metal THR Controls (C2)		I vs. C1[1] p-values	I vs. C2[2] p-values
Number of procedures	292	.	341	.	322	.	.	.
Number of patients	292	.	341	.	322	.	.	.
Gender	**n**	**%**	**n**	**%**	**n**	**%**	0.046	0.046
Males	202	69.2%	210	61.6%	198	61.5%	.	.
Females	90	30.8%	131	38.4%	124	38.5%	.	.
Age	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	<0.001	<0.001
≥65	13	4.5%	65	19.1%	66	20.5%	.	.
<65	279	95.5%	276	80.9%	256	79.5%	.	.
Males	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**		
Age at surgery (yrs)	48.8	9.6	52.5	11.5	53.3	11.9	<0.001	<0.001
Body Mass Index (kg/m^2)	28.1	4.3	29.6	5.8	30.1	6.0	0.020	0.001
Height (inches)	70.3	3.0	69.7	3.3	70.2	3.3	0.433	0.776
Weight (lbs)	197.8	32.9	204.2	40.2	210.8	42.9	0.171	0.002
Females	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**		
Age at surgery (yrs)	48.9	8.9	53.3	13.0	53.7	11.7	0.006	0.001
Body Mass Index (kg/m^2)	27.1	6.1	29.3	8.1	29.0	7.3	0.038	0.050
Height (inches)	65.1	2.9	64.2	3.5	64.4	3.1	0.035	0.125
Weight (lbs)	163.1	37.2	171.1	43.2	171.0	43.2	0.251	0.281
Diagnosis	**n**	**%**	**n**	**%**	**n**	**%**	0.157[4]	0.363[4]
Osteo/degenerative arthritis	230	78.8%	243	71.3%	243	75.5%	.	.
Avascular necrosis	34	11.6%	58	17.0%	53	16.5%	.	.
Traumatic arthritis	13	4.5%	21	6.2%	13	4.0%	.	.
Congenital hip dysplasia	15	5.1%	19	5.6%	13	4.0%	.	.
Rheumatoid Arthritis	0	0.0%	0	0.0%	0	0.0%	.	.
Health Related Quality of Life (SF-12)	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**		
SF-12 PCS Z-score[3]	-1.82	1.19	-1.88	1.09	-1.85	1.18	0.991	0.924
SF-12 MCS Z-score[3]	0.00	1.16	0.05	1.18	-0.01	1.10	0.877	0.365
Harris Hip Score	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**		
Harris Hip Total Score	49.4	11.7	45.3	12.8	47.6	14.2	<0.0001	0.026
Harris Pain Category[6]	**n**	**%**	**n**	**%**	**n**	**%**	0.052[5]	<0.0001[5]
None/Ignores	0	0.0%	1	0.3%	5	1.6%	.	.
Slight	0	0.0%	2	0.6%	10	3.1%	.	.
Mild	5	1.7%	9	2.6%	11	3.4%	.	.
Moderate	105	36.1%	88	25.8%	90	28.0%	.	.
Marked	175	60.1%	229	67.2%	185	57.6%	.	.
Totally disabled	6	2.1%	12	3.5%	20	6.2%	.	.
	n	**%**	**n**	**%**	**n**	**%**		
Any Previous Treatment	45	15.4%	58	17.0%	46	14.3%	0.587	0.695
Other Joint Involvement	75	25.7%	70	20.5%	86	26.7%	0.124	0.773
Any bone graft	63	21.6%	85	24.9%	77	23.9%	0.321	0.491

Table 7: Baseline and Demographic Characteristics for All Enrolled Unilateral (Original Shell), Bilateral (Original Shell), and All Enrolled Audited Cohorts

	All Enrolled Unilateral (Original Shell) n = 680		Bilateral (Original Shell) n = 203		All Enrolled Audited n = 1366	
	N	%	N	%	N	%
Number of procedures	680		203		1366	
Number of patients	680		118		1206	
Gender	**N**	**%**	**N**	**%**	**N**	**%**
Males	484	71.2%	153	75.4%	981	71.8%
Females	196	28.8%	50	24.6%	385	28.2%
Age	**n**	**%**	**n**	**%**	**n**	**%**
≥65	42	6.2%	11	5.4%	104	7.6%
<65	638	93.8%	192	94.6%	1262	92.4%
Males	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age at surgery (yrs)	50.1	9.9	49.1	10.0	50.3	9.9
Body Mass Index (kg/m^2)	28.1	4.2	27.4	3.7	28.0	3.9
Height (inches)	70.4	2.7	70.7	3.0	70.6	2.8
Weight (lbs)	198.6	32.9	195.7	32.4	198.3	32.0
Females	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age at surgery (yrs)	48.7	10.1	45.3	8.5	49.6	10.7
Body Mass Index (kg/m^2)	26.2	5.3	27.3	6.5	26.4	5.4
Height (inches)	64.9	2.8	65.6	3.6	65.2	3.0
Weight (lbs)	157.2	33.6	166	37.2	159.8	34.1
Diagnosis	**n**	**%**	**n**	**%**	**n**	**%**
Osteo/degenerative arthritis	519	76.3%	159	78.3%	1054	77.2%
Avascular necrosis	70	10.3%	28	13.8%	138	10.1%
Traumatic arthritis	31	4.6%	0	0.0%	39	2.9%
Congenital hip dysplasia	41	6.0%	16	7.9%	100	7.3%
Rheumatoid Arthritis	19	2.8%	0	0.0%	35	2.6%
Health Related Quality of Life (SF-12)	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
SF-12 PCS Z-score	-1.88	1.16	-2.21	1.22	-1.92	1.16
SF-12 MCS Z-score	0.15	1.10	0.22	1.13	0.20	1.10
Harris Hip Score	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Total Score	50.6	12.0	49.6	12.9	50.7	11.9
Harris Pain Category[1]	**n**	**%**	**n**	**%**	**n**	**%**
None/Ignores	1	0.1%	1	0.5%	2	0.1%
Slight	5	0.7%	1	0.5%	7	0.5%
Mild	12	1.8%	8	4.0%	36	2.6%
Moderate	267	39.4%	70	34.7%	507	37.2%
Marked	377	55.6%	112	55.4%	781	57.3%
Totally disabled	16	2.4%	10	5.0%	29	2.1%
Any Previous Treatment	96	14.1%	10	4.9%	167	12.2%
Other Joint Involvement	172	25.3%	170	83.7%	550	40.3%
Any bone graft	164	24.1%	35	17.2%	281	20.6%

Note:
[1] Two patients were missing pain assessment in baseline Harris Hip Score.

Table 9: Risk of Revision in All Enrolled Unilateral (Original Shell), Pivotal Unilateral Efficacy Cohort (Original Shell), and Bilateral (Original Shell)
Stratified by All Procedures in Cohort and Only Procedures with At Least 24 Months Follow-up

		All Enrolled Unilateral (Original Shell)	All Enrolled Unilateral (Original Shell) 24+ month follow-up	Pivotal Unilateral Efficacy Cohort[1] (Original Shell)	Pivotal Unilateral Efficacy Cohort (Original Shell) 24+ month follow-up	Bilateral (Original Shell)	Bilateral (Original Shell) 24+ month follow-up
	Revisions	36	36	19	19	11	11
	N	680	540	292	270	203	160
	%	5.3	6.7	6.5	7.0	5.4	6.9
Female gender	Female	7.7% (15/196)	9.0% (15/167)	11.1% (10/90)	11.5% (10/87)	16.0% (8/50)	18.2% (8/44)
	Male	4.3% (21/484)	5.6% (21/373)	4.5% (9/202)	4.9% (9/183)	2.0% (3/153)	2.6% (3/116)
Non osteoarthritis DX	AVN/RA+	8.7% (14/161)	11.1% (14/126)	6.5% (4/62)	7.0% (4/57)	9.1% (4/44)	12.5% (4/32)
	Osteoarthritis	4.2% (22/519)	5.3% (22/414)	6.5% (15/230)	7.0% (15/213)	4.4% (7/159)	5.5% (7/128)
Baseline HHS < 43.6 (1st quartile)[2]	HHS<43.6	4.7% (8/169)	6.1% (8/132)	5.1% (4/78)	5.8% (4/69)	3.3% (2/61)	4.3% (2/47)
	HHS>=43.6	5.4% (27/496)	6.8% (27/400)	7.1% (15/212)	7.5% (15/199)	6.7% (9/135)	8.1% (9/111)
Baseline Pain >=Marked[3]	Marked/Disabled	5.3% (21/393)	6.6% (21/319)	6.1% (11/181)	6.6% (11/167)	3.3% (4/122)	4.3% (4/93)
	Other	5.3% (15/285)	6.8% (15/220)	7.3% (8/110)	7.8% (8/102)	8.8% (7/80)	10.4% (7/67)
Any Previous Treatment	Prev Treatment	6.3% (6/96)	7.5% (6/80)	8.9% (4/45)	9.3% (4/43)	20.0% (2/10)	28.6% (2/7)
	none	5.1% (30/584)	6.5% (30/460)	6.1% (15/247)	6.6% (15/227)	4.7% (9/193)	5.9% (9/153)
Other Joint Involvement	Joint Involved	9.3% (16/172)	12.4% (16/129)	9.3% (7/75)	10.1% (7/69)	5.9% (10/170)	7.6% (10/132)
	none	3.9% (20/508)	4.9% (20/411)	5.5% (12/217)	6.0% (12/201)	3.0% (1/33)	3.6% (1/28)
Any Bone Graft	Bone Graft	4.3% (7/164)	5.4% (7/130)	7.9% (5/63)	8.6% (5/58)	2.9% (1/35)	3.3% (1/30)
	none	5.6% (29/516)	7.1% (29/410)	6.1% (14/229)	6.6% (14/212)	6.0% (10/168)	7.7% (10/130)
Femoral Cysts (Multiple vs not multiple)	>1	4.0% (8/199)	4.7% (8/171)	3.4% (3/89)	3.5% (3/85)	12.0% (6/50)	14.3% (6/42)
	0,1	5.8% (28/481)	7.6% (28/369)	7.9% (16/203)	8.6% (16/185)	3.3% (5/153)	4.2% (5/118)
Femoral Cysts (Any vs none)	Any	6.5% (10/153)	8.3% (10/120)	12.2% (9/74)	12.9% (9/70)	1.8% (1/55)	2.2% (1/45)
	None	4.9% (26/527)	6.2% (26/420)	4.6% (10/218)	5.0% (10/200)	6.8% (10/148)	8.7% (10/115)
1st 60 procedures at a specific site	Within 1st 60	8.0% (28/350)	9.1% (28/308)	7.7% (18/234)	8.2% (18/220)	11.0% (10/91)	12.0% (10/83)
	After 1st 60	2.4% (8/330)	3.4% (8/232)	1.7% (1/58)	2.0% (1/50)	0.9% (1/112)	1.3% (1/77)
Small Femoral Component	< 44	9.0% (18/199)	10.5% (18/171)	12.5% (12/96)	13.2% (12/91)	19.5% (8/41)	22.2% (8/36)
	>=44	3.7% (18/481)	4.9% (18/369)	3.6% (7/196)	3.9% (7/179)	1.9% (3/162)	2.4% (3/124)
Femoral Comp. Neck angle<135°[4,5]	<135°	4.8% (17/354)	5.4% (17/313)	6.3% (12/192)	6.6% (12/181)	5.1% (5/99)	5.7% (5/87)
	>=135°	5.0% (16/318)	7.2% (16/223)	4.2% (4/96)	4.7% (4/86)	5.0% (5/100)	6.9% (5/72)
Stem Neck angle<135°[4,5]	<135°	4.1% (10/246)	4.6% (10/216)	6.1% (7/114)	6.5% (7/108)	4.4% (3/68)	5.1% (3/59)
	>=135°	5.4% (23/426)	7.2% (23/320)	5.2% (9/174)	5.7% (9/159)	5.3% (7/131)	7.0% (7/100)
Too Horizontal Acetabular Component (<30° vs not <30°)[4,6]	<30°	12.5% (5/40)	14.7% (5/34)	13.8% (4/29)	14.3% (4/28)	18.8% (3/16)	21.4% (3/14)
	not <30°	4.4% (28/632)	5.6% (28/502)	4.6% (12/259)	5.0% (12/239)	3.8% (7/184)	4.8% (7/145)
Too Vertical Acetabular Component[4,6]	>60°	4.9% (33/672)	6.2% (33/536)	5.6% (16/288)	6.0% (16/267)	5.0% (10/200)	6.3% (10/159)
	not <60°						

Note:
1. There were no Rheumatoid Arthritis patients included in the Pivotal Unilateral Efficacy Cohort (Original Shell).
2. Regarding Baseline HHS < 43.6 (1st Quartile): 15 evaluations in the All Enrolled Unilateral Cohort (Original Shell), 8 evaluations in the All Enrolled Unilateral Cohort (Original Shell) 24+ Month follow-up, 2 evaluations in the Pivotal Unilateral Efficacy Cohort (Original Shell), 2 evaluations in the Pivotal Unilateral Efficacy Cohort 24+ Month follow-up, 8 evaluations in the Bilateral Cohort (Original Shell) and 2 evaluations in the Bilateral Cohort (Original Shell) 24+ Month follow-up had an incomplete HHS evaluation at Baseline.
3. Regarding Baseline Pain >/= Marked: 2 evaluations in the All Enrolled Unilateral Cohort (Original Shell), 1 evaluation in the All Enrolled Unilateral Cohort (Original Shell) 24+ Month follow-up, 1 evaluation in the Pivotal Unilateral Efficacy Cohort (Original Shell), 1 evaluation in the Pivotal Unilateral Efficacy Cohort 24+ Month follow-up, and 1 evaluation in the Bilateral Cohort (Original Shell) had an incomplete Harris Hip Score Pain assessment at Baseline.
4. Regarding Femoral Component Neck Angle, Stem Neck Angle, Too Horizontal Acetabular Component, and Too Vertical Acetabular Component: 8 evaluations in the All Enrolled Unilateral Cohort (Original Shell), 4 evaluations in the All Enrolled Unilateral Cohort (Original Shell) 24+ Month

follow-up, 4 evaluations in the Pivotal Unilateral Efficacy Cohort (Original Shell), 3 evaluations in the Pivotal Unilateral Efficacy Cohort 24+ Month follow-up did not have baseline post-operative radiographic evaluation performed.
[5.] 4 evaluations in the Bilateral Cohort (Original Shell) did not have Femoral neck or stem angle assessed at the baseline.
[6.] 3 evaluations in the Bilateral Cohort (Original Shell) did not have Acetabular cup inclination assessed at the baseline.

Table 10 summarizes the Cox proportional hazards regression analyses for each variable assessed for the Pivotal Unilateral Efficacy (Original Shell), All Enrolled Unilateral (Original Shell) and Bilateral (Original Shell) cohorts. Variables were analyzed and deemed risk factors if the lower bound of the 95% confidence interval for the hazards ratio was ≥ 1. On the basis of that statistical definition of risk factor, eight variables were deemed risk factors:

- female gender,
- small femoral component (≤ 44mm),
- procedures within the surgeon's first 60 cases,
- diagnosis of avascular necrosis, traumatic arthritis, congenital hip dysplasia, or rheumatoid arthritis,
- any previous treatment to the hip,
- multiple femoral cysts,
- acetabular component position of < 30°, and
- any other joint involvement.

Table 10:
Cox Regression Hazard Ratios and 95% Confidence Intervals for Each Potential Revision Risk Factor Evaluated One-at-a-Time

		Pivotal Unilateral Efficacy Cohort (Original Shell)	All Enrolled Unilateral (Original Shell)	Bilateral (Original Shell)
	Revisions	19	36	11
	N = Overall	292	680	203
	N = Month 24+	270	540	160
	%	7.0%	6.7%	6.9%
Female gender	Hazard	2.24	1.63	6.87
	LB	0.91	0.84	1.82
	UB	5.55	3.17	25.96
Non osteoarthritis Diagnoses	Hazard	0.77	1.98	2.17
	LB	0.24	1.00	0.63
	UB	2.42	3.89	7.45
Any Previous Treatment	Hazard	1.33	1.11	5.57
	LB	0.44	0.46	1.19
	UB	4.04	2.68	26.00
Other Joint Involvement	Hazard	1.79	2.61	2.19
	LB	0.70	1.35	0.28
	UB	4.55	5.05	17.15
Femoral Cysts Multiple vs none	Hazard	0.61	0.65	3.43
	LB	0.16	0.30	1.05
	UB	2.37	1.43	11.26
Procedures done	Hazard	3.68	2.60	7.39

Metal Ions

While concerns exist with regard to the local and systemic effects of metal ions, in the vast majority of patients there is no direct evidence linking metal-on-metal arthroplasty with long-term medical problems. A study performed on 25 patients with the CONSERVE® Plus Total Resurfacing Hip System was reported by Skipor, *et al.*, in, "Serum and urine metal levels in patients with metal-on-metal surface arthroplasty," *J Mat Sci Mat Med* 13 (2002), p.1227-34.[9] Head sizes for these patients ranged from 38 to 52mm. Serum cobalt and chromium and urine chromium analysis revealed levels that do not differ widely from metal-on-metal values reported in the literature, although they are higher than other bearings. Mean serum cobalt and chromium at 12 months were 1.07 (+/- 0.26) and 1.80 (+/- 0.45) parts per billion (ppb), respectively. Mean urine chromium at 12 months was 2.21 (+/- 0.83) ppb. In summary, while ions will be higher in patients who receive metal-on-metal hip implants versus patients who receive other bearing surfaces (i.e., metal-on-polyethylene, ceramic-on-ceramic), in the vast majority of patients there has been no direct evidence demonstrating that elevated levels adversely effect health.

The Oxford research group presented their findings related to 115 cases in which 6 patients (5 female, 1 male) implanted with 9 hips (3 bilateral, 3 unilateral) presented with 9 pseudotumors and higher median serum cobalt and serum chromium ion levels as compared to those cases without pseudotumors. Moreover, two of these 9 pseudotumors exhibited signs of lymphocyte infiltration indicative of delayed hypersensitivity reaction (ALVAL). This led the authors to conclude that "an asymptomatic pseudotumour in patients with metal-on-metal hip resurfacing is associated with elevated serum cobalt and chromium ion levels, suggesting that abnormal wear may be the cause of pseudotumour. The precise mechanism is unclear and may be due to metal hypersensitivity reaction or toxic effects. "Metal Ion Levels In Asymptomatic Pseudotumours Associated With Metal-on-metal Hip Resurfacings." Kwon, et. al. Paper No. 44, *55th Annual Meeting of the Orthopaedic Research Society, Las Vegas, 2009.*[10]

Appropriate information related to this matter has been included within the labeling.

2. <u>Effectiveness Results</u>

Effectiveness was evaluated primarily by the Composite Clinical Success (CCS) definition. Harris Hip Score, radiographic outcome, and Health Related Quality of Life (SF-12) Scores were also evaluated as a measure of effectiveness.

Harris Hip Score

As seen in Table 20, the mean Month 24+ Harris Hip Total score was 94.4 in the CONSERVE® Plus Pivotal Unilateral Efficacy cohort (Original Shell). This compares to 94.1 and 92.7 for patients in the TRANSCEND® Ceramic and Metal THR Unilateral Control cohorts, respectively.

Mean 24+ Harris Hip function score was 45.1, 44.4 and 43.4, for CONSERVE® Plus Pivotal Unilateral Efficacy (Original Shell), TRANSCEND® Ceramic, and TRANSCEND® Metal Unilateral control cohorts, respectively.

Mean 24+ Harris Hip Range of Motion (ROM) score was 4.82, 4.88, and 4.81 for the CONSERVE® Plus Pivotal Unilateral Efficacy (Original Shell), TRANSCEND® Ceramic, and TRANSCEND® Metal Unilateral control cohorts, respectively.

Metal Ion Levels In Asymptomatic Pseudotumours Associated With Metal-on-metal Hip Resurfacings

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Introduction: Metal-on-metal hip resurfacing arthroplasty (MoMHRA) has undergone a recent resurgence as an alternative treatment option for young and active patients with significant hip osteoarthritis. A series of symptomatic 'pseudotumours' or soft-tissue masses relating to the hip joint have been reported in patients following this procedure [1]. The soft-tissue mass was found be locally destructive, requiring revision surgery in a high percentage of patients. The incidence of symptomatic pseudotumours has been reported to be 1% and they were associated with elevated serum metal levels. Asymptomatic pseudo-tumours have not been previously investigated. The aims of this study were two-fold: (1) to determine the incidence; and (2) to measure serum metal ion levels in MoMHRA patients with asymptomatic pseudotumours.

Materials and Methods: A total of 115 MoMHRA implanted hips (80 patients; 48 male, 32 female, mean age 56 years, range 33-73) were evaluated in this Institutional Review Board approved study. Patients were identified from a prospective MoMHRA database at the authors' institution. Those patients who had MoMHRA performed at least one year previously were invited on an all-comer basis to participate in the study. The mean follow-up was 61 months (range 13-88). Radiographs and Oxford Hip scores (OHS) were assessed. Any cystic or solid masses detected on the screening ultrasound (US) scan were confirmed using magnetic resonance imaging (MRI). Patients with a soft-tissue mass had an aspiration or biopsy performed. The core needle biopsy samples were fixed in formalin and stained with haematoxylin and eosin and other standard stains (gram, Ziehl-Neelsen, PAS, Grocott or Giemsa staining). Serum cobalt and chromium levels were analysed in a blinded fashion using Inductively-Coupled Plasma Spectrometer. The serum levels and OHS were compared (Mann-Whitney tests) between those cases found to have pseudotumours with those without pseudotumours.

Results: The preliminary results of this on-going study indicated the incidence of asymptomatic pseudotumours was 8%. Pseudo-tumours were found in 6 patients (5 female: 1 male) with solid (n=2) and cystic (n=7) masses. Pseudotumours were found in both hips in three out of four bilateral patients. Histological examinations of solid mass obtained in two cases showed extensive necrosis and diffuse lymphocyte infiltration with B cells, T lymphocytes and plasma cells. The presence of pseudotumour was associated with: (1) higher median serum cobalt levels, 5.6 µg/L (range 8-22.5) vs. 1.7µg/L (range 0.5-33.3), p<0.01, Mann-Whitney test, (Figure 1); and (2) higher median serum chromium levels, 7.2µg/L (range 1-22.8) vs. 1.8µg/L (range 0.5-21.2) p=0.01 (Figure 2); and (3) inferior OHS, 18.9 (range 13.0-24.8) vs. 13.9 (range 12.9-14.9) p=0.08. Three out of four patients in the non-pseudo-tumour group, who had either extreme or outlier values, reported the presence of other orthopaedic metal implants in situ (e.g. spinal fusion and fracture metal implants).

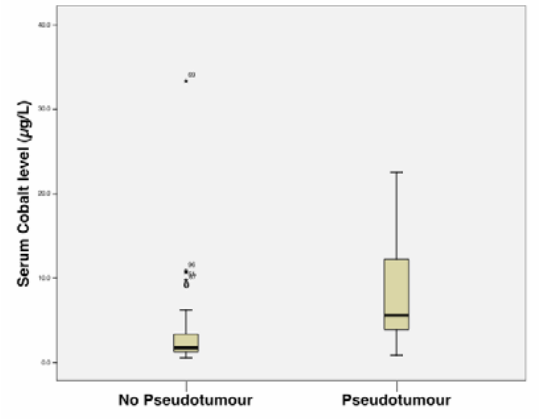

Figure 1: Comparison of serum Cobalt level measurements.

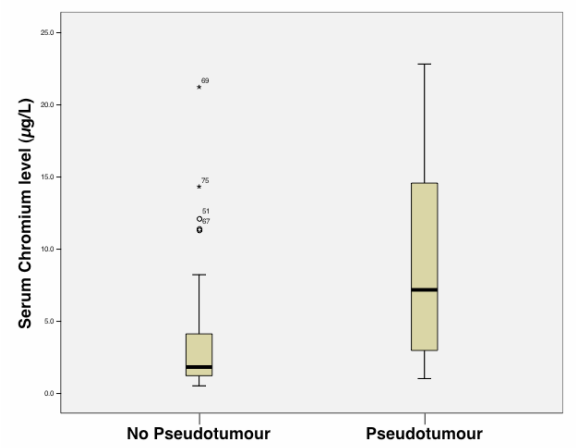

Figure 2: Comparison of serum Chromium level measurements.

Discussion: The incidence of asymptomatic pseudo-tumours during the first six post-operative years is significantly higher than the reported incidence of symptomatic pseudotumours. The current study also shows a very high (15%) incidence of asymptomatic abnormal soft tissue reaction in females. Further research is needed to determine if these will develop into symptomatic pseudo-tumours.

The histological features of the solid mass were similar to those previously described as ALVAL (aseptic lymphocyte dominated vasculitis associated lesion), suggesting a T lymphocyte-mediated hypersensitivity reaction of type IV (delayed type hypersensitivity) [2]. However, the incidence of pseudotumour far exceeds the metal hypersensitivity reactions leading to adverse clinical outcome, which are currently estimated to affect < 1% of the patients with implants [3]. Thus, the results of this study demonstrate that an asymptomatic pseudo-tumour in patients with MoMHRA is associated with elevated serum cobalt and chromium ion levels, suggesting that abnormal wear may be the cause of pseudotumour. The precise mechanism is unclear and may be due to metal hypersensitivity reaction or toxic effects.

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