
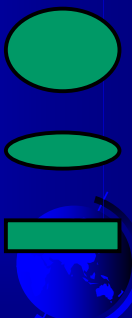

**2006 AAOS  
Plus Orthopedics  
Booth  
Presentation  
March 23, 2006**


**Why Tapered and Why  
Lateralized Femoral Stem Design**

**Todd V. Swanson, MD**  
**Desert Orthopaedic Center**  
**Las Vegas, Nevada**

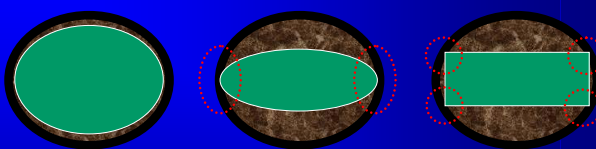
**Tapered Stem Designs**

- Canal filling (Mallory-Head, Synergy)
- Flat, Oval (Taperloc, Accolade)
- Flat, Rectangular (Zweymüller, CLS)



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**Primary Torsional Stability**

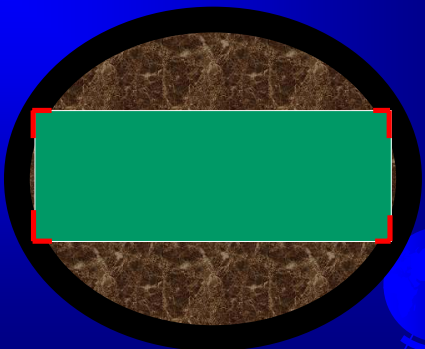


**Perfect fit & fill provides best stability (but rarely achievable)**

**Good fit without fill gets stability from macro-interlock and friction between prosthesis & cortical bone**

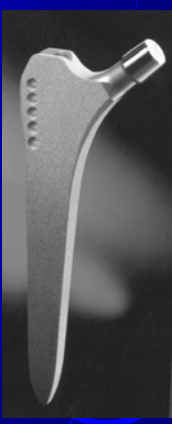
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**Corner-Cortical Interlock**



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**In 1979, Karl Zweymüller implanted the first cementless, tapered, cornered femoral component of his design**



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**Zweymüller Philosophy**

- Tapered AP and ML
- Rectangular
- Non-canal filling
- Grit-blast finish only
- Lateral metaphyseal flare to increase primary torsional stability



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## The most widely used cementless hip stem in Europe

- >700,000 stems implanted worldwide since inception
  - >600,000 in Europe
  - Most common cementless stem used in Europe
- >300,000 SL-Plus implanted since 1992

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7 DDC

## Advantages of Flat, Rectangular, Tapered Stem

The Journal of Arthroplasty Vol. 20 No. 4 Suppl. 2 2005

### The Tapered Press Fit Total Hip Arthroplasty A European Alternative

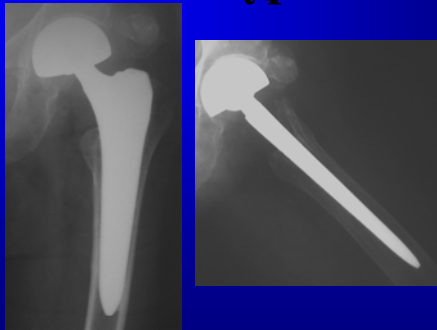
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8 DDC

## Excellent primary stability, even in Type C bone

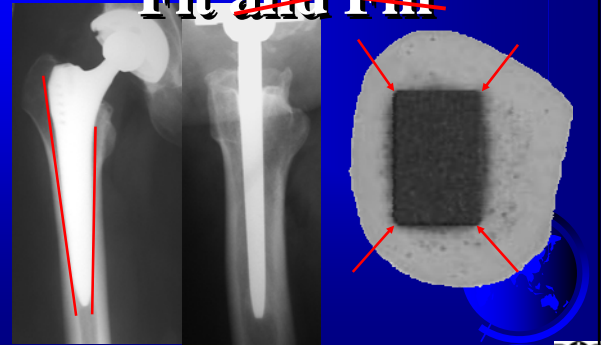


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10 DDC

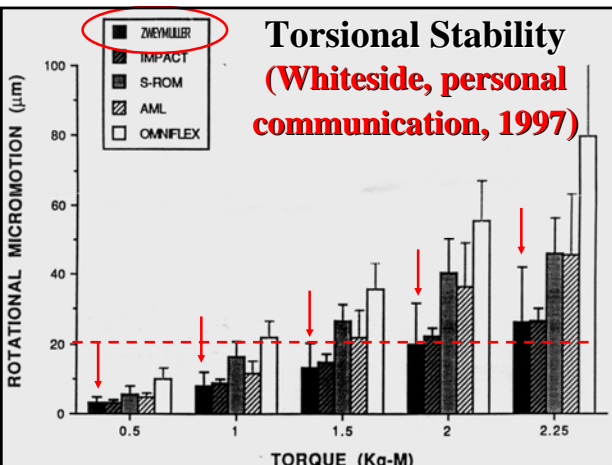
## Primary Stability ~~Fit and Fill~~



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11 DDC



## Reliable Osseo-Integration

Study	Clinical Cases (# hips)	Age (years)	Follow-Up (years)	Survival Rate
Grubl, et al. Z Orthop Ihre Grenzgeb, 2003	848	62.2	6.8	98.6%
Grubl, et al. JBJS-A, 2002				
Pieringer, JBJS-B, 2003	48	>80	6.5	100%
Pieringer, et al. J Arth, 2003	100	58.0	≥10	100%
Garcia-Cimbrelo, et al. JBJS-A, 2003	124	62.3	11.3	100%
Bonnomet, Rev Chir Orthop Reparatrice Appar Mot, 2001	115	52	8.2	99.2%
Traulsen, et al. Z Orthop Ihre Grenzgeb, 2001	113		8.9	96.0%
Weissinger & Helmreich, Z Orthop Ihre Grenzgeb, 2001	113	72	10.6	99.1%
Delaunay & Kapandji, JBJS-B, 2001	200	65.9	6.0	99.3%
Delaunay, et al. J Arth, 2001	118	55.7	7.3	100%
Havelin, et al. JBJS-B, 1995	333	53	3.9	99.1%
Huo, et al. J Arth, 1995	46	65.3	4.2	100%
<b>TOTALS &amp; WEIGHTED AVERAGES:</b>	<b>2,158</b>	<b>60.9</b>	<b>7.1</b>	<b>98.9%</b>
My Results	1,000	63.3	3.1	100%

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13 DDC

## Cancellous Bone Compaction

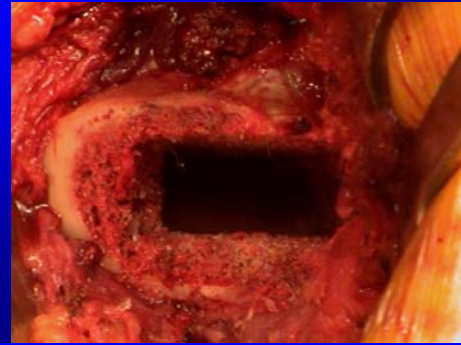
- Delays stress shielding
- Increases primary stability
- Maintains endosteal blood supply

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14 DDC

## Cancellous Bone Compaction

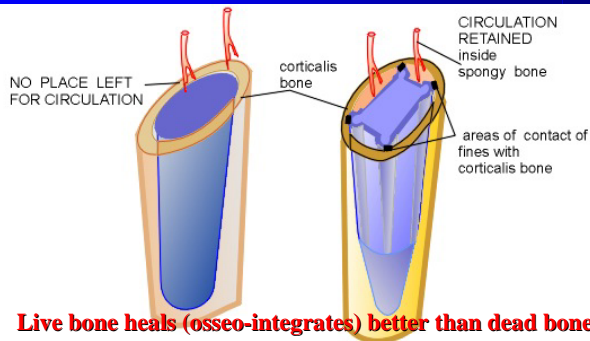


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15 DDC

## Preservation of blood supply



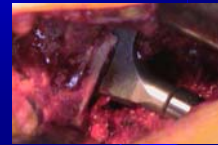
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17 DDC

## Simplicity of removal

- Non-canal-filling stem allows for introduction of thin osteotomes
- Occasional extended trochanteric osteotomy needed due to excellent secondary fixation
  - Easily performed
  - Easily repaired

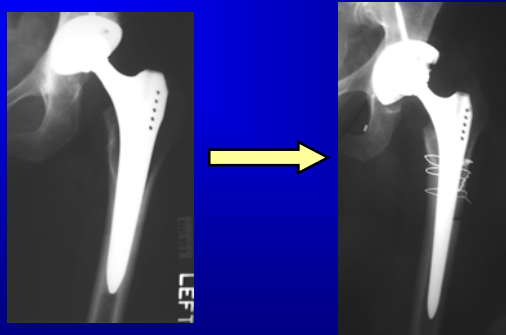


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18 DDC

## Removal & Reimplantation



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19 DDC

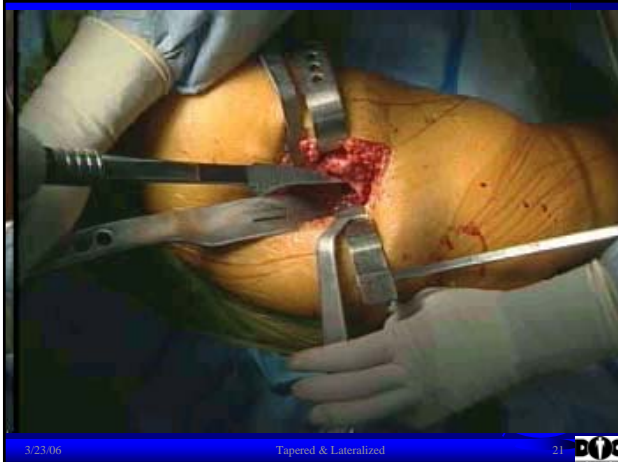
## Simplicity of bone preparation

- Broach only
- “Woodpecker” pneumatic broach

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20 DDC



## Fracture Rate

- **4 fractures/1000 cases (0.4%)**
  - 2 hand broaching
  - 2 pneumatic broaching
- **All in extremely osteoporotic bone**

3/23/06 Tapered & Lateralized 22 POC

### Minimal thigh pain

	N	Age (years)	F/U (years)	Thigh Pain
Huo, et al, J Arth, 1995	46	65.3	4.2	0
Pieringer, et al, JBJS-B, 2003	87	≥80	5.8	0
Delaunay, J Arth, 2001	118	55.7	5-10	2.5%
Grubl, et al, JBJS-A, 2002	208	61	≥10	1.9%
Garcia-Cimbrelo, et al, JBJS-A, 2003	124	62.3	11.3	1.9%
<b>TOTALS &amp; WEIGHTED AVERAGES</b>	<b>583</b>	<b>63.4</b>	<b>8.7</b>	<b>1.6%</b>
<b>My Results</b>	<b>1,000</b>	<b>63.3</b>	<b>3.1</b>	<b>1.2%</b>

3/23/06 Tapered & Lateralized 23 POC

### Minimal osteolysis

	N	Age (years)	F/U (years)	Osteolysis
Huo, et al, J Arth, 1995	46	65.3	4.2	0
Delaunay, J Arth, 2001	118	55.7	5-10	3.4%
Pieringer, et al, JBJS-B, 2003	87	≥80	5.8	1.1%
Delaunay & Kapandji, JBJS-B, 2001	200	65.9	2-11	1%
Grubl, et al, JBJS-A, 2002	208	61	≥10	0
Pieringer, et al, J Arth, 2003	100	58.0	≥10	11% (primarily Gruen zones 1,7,8)
Garcia-Cimbrelo, et al, JBJS-A, 2003	124	62.3	11.3	17%
<b>TOTALS &amp; WEIGHTED AVERAGES:</b>	<b>883</b>	<b>63.3</b>	<b>8.3</b>	<b>4.4%</b>
<b>My Results:</b>	<b>1,000</b>	<b>63.3</b>	<b>3.1</b>	<b>6.8% (Gruen zones 1,7)</b>

3/23/06 Tapered & Lateralized 24 POC

### Minimal Stress Shielding

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### Minimal Stress Shielding

- **3 point fixation always provides intimate contact with posterior calcar**

3/23/06 Tapered & Lateralized 26 POC

## Stress Shielding

	N	Age (yrs)	F/U (yrs)	Stress Shielding
Brodner, JBJS-B, 2004	100	60	5	Decrease Gruen 1,6,7 (3-14%) Increase Gruen 2,4,5 (3-11%) Net change 0
DeLaunay, J Arth, 2001	118	55.7	5-10	10.1% Gruen zones 1,7
Pieringer, et al, JBJS-B, 2003	87	≥80	5.8	16% (primarily Gruen Zones 1,2,7)
Pieringer, et al, J Arth, 2003	100	58.0	≥10	12% primarily Gruen Zones 1,7
Grubl, et al, JBJS-A, 2002	208	61	≥10	59% (primarily Gruen Zones 1,7)
Garcia-Cimbrelo, et al, JBJS-A, 2003	124	62.3	11.3	23%
TOTALS & WEIGHTED AVERAGES:	737	62.1	8.6	26.8%
My Results:	1,000	63.1	3.1	8.6% (Gruen zones 1,7)

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## Intra-op Adjustability

- Sharp, cutting broaches allow intra-op changes
  - In prosthesis height
    - Leg length
    - Soft tissue tension
  - In prosthesis anteversion

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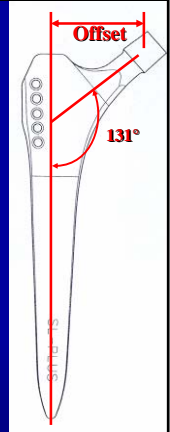
Tapered & Lateralized

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## Standard Offset Stem

- 14 sizes
- Neck angle = 131°
- Offset proportional to stem size
  - Size 01, med head: 32.2 mm
  - Size 12, med head: 48.9 mm



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30



## Lateralized Offset Stem

- Introduced in April, 2002
- 12 sizes available
- Geometry of body unchanged
- 123° neck angle
- Offset increased by 6.0 – 8.6 mm for med neck length

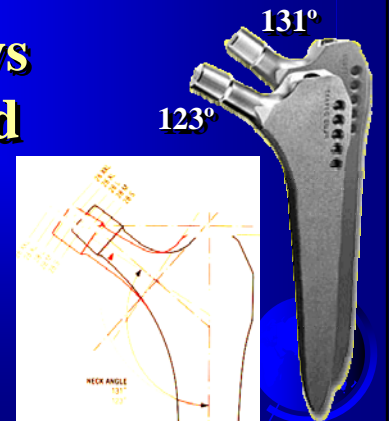
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## Lateral vs Standard Offset



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## Clinical Experience: First 441 SL-Plus Stems

- 46 months (5/97 – 3/01)
- Single surgeon
- All standard offset stems
- All posterior, single-incision MIS THA's

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35



## Dislocation Rate

- $24/441 = 5.4\%$
- 92% LLD < 7mm

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Tapered & Lateralized

36



## Recent Experience

- 27 months (4/02 – 7/04)
- 416 THA's using SL-Plus
  - 159 Lateralized stems (38%)
  - 257 Standard offset stems
- Dislocation rate  $2/416 = 0.5\%$
- 95% LLD < 5 mm

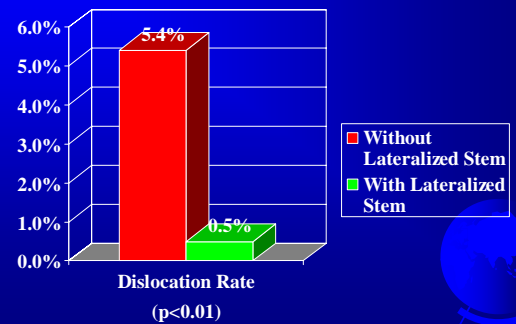
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## Dislocation Rates



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## Indications for Lateralized Stem

- High offset anatomy
  - Varus or long femoral neck
  - Protrusio
- Small canal (Funnel-shaped, Type A femur)
- Clinical indications
  - Excess laxity on stability testing (osteophytes)
  - Inadequate intra-operative stability both anteriorly and posteriorly

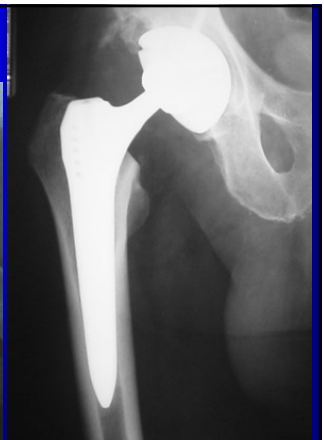
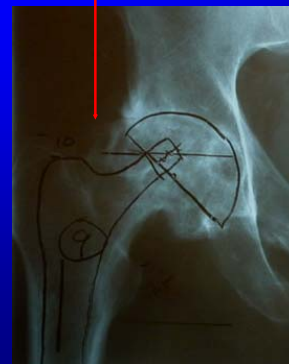
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## High Offset Hip



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