

 PS™ **Optimized**  
Positioning System  
The evidence base

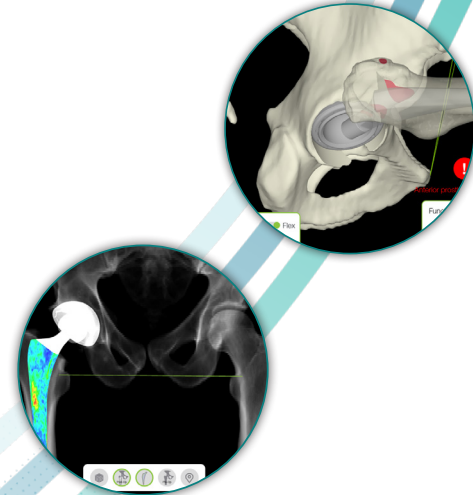
**Corin**  
Connected Orthopaedic Insight

Intended for Healthcare Professionals only

# OPS™ Optimized Positioning System

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## Dynamic analysis of functional patient-specific movement:

- Patient-specific pelvic mobility
- Prosthetic and bony impingement
- Precise execution of the patient-specific plan

## 1. Over 50% of revision THAs could be avoidable

**Title** Can some early revision total hip arthroplasties be avoided?

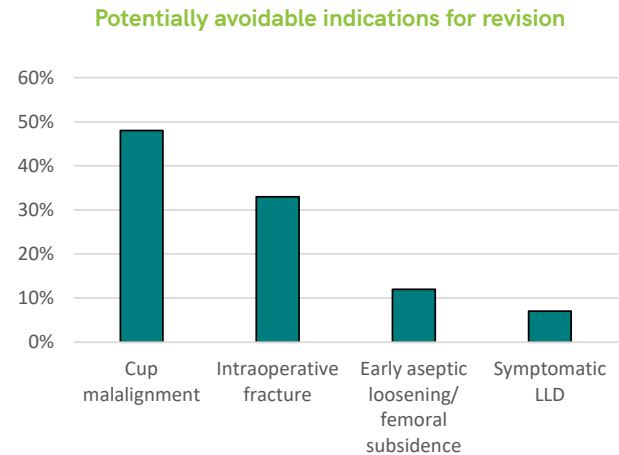
**Authors** Novikov D, Mercuri JJ, Schwarzkopf R, Long WJ, Bosco III JA, Vigdorich JM

**Publication** [The Bone and Joint Journal, vol. 101-B, 2019](#)

**Methods** Three adult reconstruction surgeons at a US academic tertiary care institution reviewed radiographs and medical records of 117 patients, classifying revision THAs into potentially avoidable and unavoidable categories.

**Results** 51.3% of revision THAs were deemed potentially avoidable. Avoidable factors included suboptimal positioning of the acetabular component (48%), intraoperative fracture (33%), early (<2 weeks) aseptic loosening (11.7%) and symptomatic LLD >1cm (6.7%).

**Conclusions** A large proportion of acute revision THAs are potentially avoidable. Surgeons must carefully evaluate the indications for revision THAs in their practice and identify new methods to address these issues.



**Incidence of reasons for potentially avoidable revision**

## 2. Impingement occurs in over 50% of revision cases

**Title** Component impingement in total hip arthroplasty: frequency and risk factors. A continuous retrieval analysis series of 416 cups

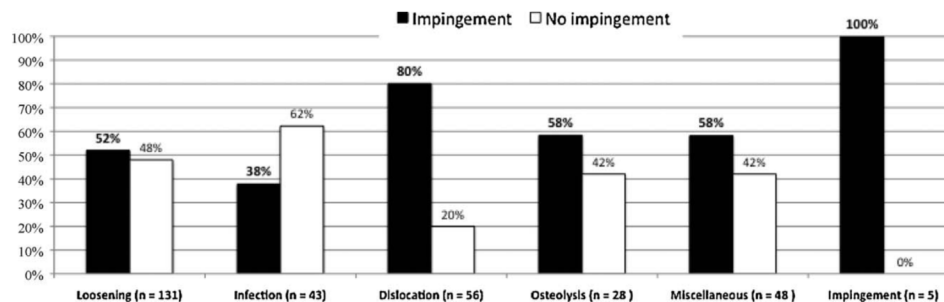
**Authors** Marchetti E, Krantz N, Berton C, Bocquet D, Fouilleron N, Migaud H, Girard J

**Publication** [Orthopaedics & Traumatology: Surgery & Research, vol. 97, 2011](#)

**Methods** Examination of evidence of prosthetic impingement in 416 THA revisions and investigation of associated risk factors. 311 cases were identified with complete data sets and referenced in results.

**Results** Implant removal was for aseptic loosening, infection, instability, osteolysis, unexplained pain or impingement. Impingement was observed in 59.2% of cases. Impingement associated with revision correlated with instability, younger age, greater hip RoM or use of an extended femoral head flange.

**Conclusions** Impingement is often discovered during THA revision (59.2%), even when it is not the primary reason for revision. Implant orientation should consider the patient's individual RoM.



Distribution of impingement according to reason for revision

### 3. Instability is the most common indication for revision

**Title** Instability Is the Most Common Indication for Revision Hip Arthroplasty in the United States: National Trends From 2012 to 2018

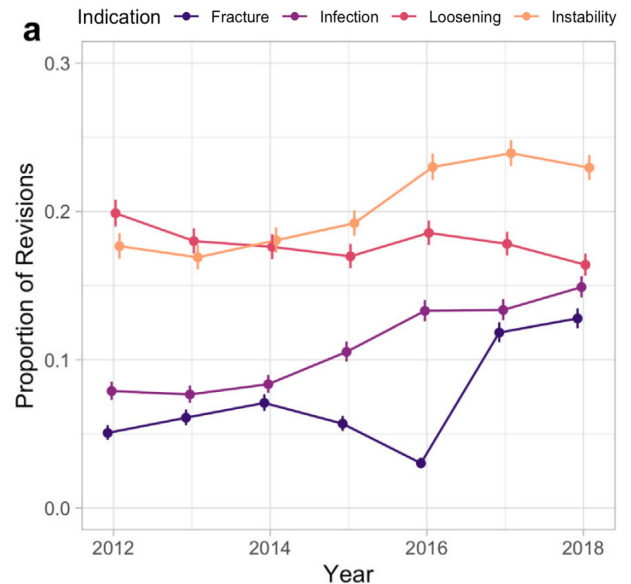
**Authors** Upfill-Brown A, Hsiue PP, Sekimura T, Patel JN, Adamson M, Stavrakis AI

**Publication** [Arthroplasty Today 11 \(2021\) 88-101](#)

**Methods** 292,250 revision THAs (rTHA) performed from 2012 to 2018 were reviewed using the National Inpatient Sample.

**Results** The annual number of rTHA procedures increased by 28.1% from 2012 to 2018 (37,325 to 47,810). The top 3 indications for rTHA were instability (20.4%), aseptic loosening (17.8%), and infection (11.1%).

**Conclusions** Instability was the most common indication for rTHA between 2012 and 2018.



## 4. The Lewinnek 'safe' zone

**Title** What safe zone? The vast majority of dislocated THAs are within the Lewinnek safe zone for acetabular component position

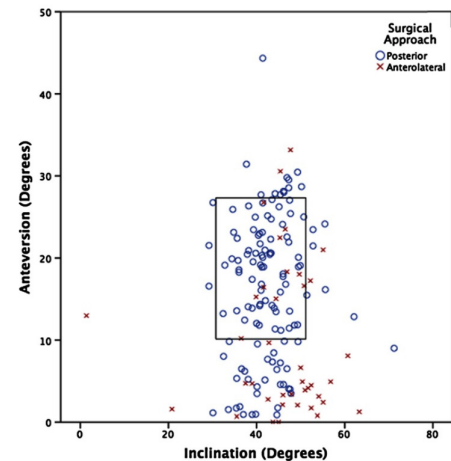
**Authors** Abdel MP, von Roth P, Jennings MT, Hanssen AD, Pagnano MW

**Publication** [Clinical Orthopaedics and Related Research, vol. 474, 2015](#)

**Methods** Retrospectively identified 206 THAs that reported dislocation from a cohort of 9,784 primary THAs performed at a single US academic tertiary care institution.

**Results** 58% of dislocations were orientated within the Lewinnek safe zone ( $40^\circ / 15^\circ \pm 10^\circ$ ). Despite achieving a safe zone orientation in 2x more cases, THA via a posterior approach was 3x more likely to dislocate than after an Ant/Lat approach.

**Conclusions** The historical target values for cup inclination and anteversion are not an accurate predictor of dislocation. The reasons for dislocation are likely multifactorial and the ideal cup position is patient specific.



Comparison of surgical approaches and dislocators within the Lewinnek safe zone

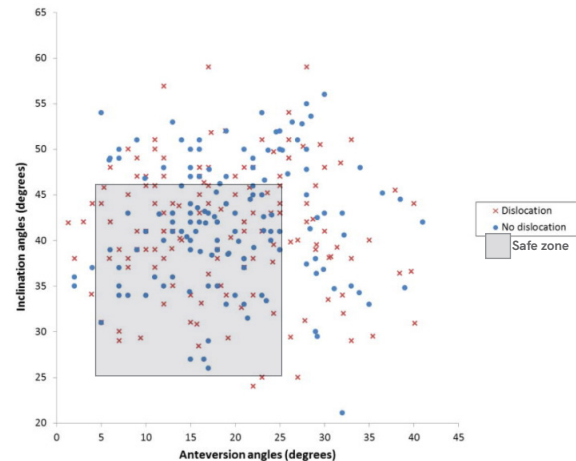
## 5. A true, universal safe zone does not exist

Title	Cup position alone does not predict risk of dislocation after hip arthroplasty
Authors	Esposito CI, Gladnick BP, Lee Y, Lyman S, Wright TM, Mayman DJ, Padgett DE
Publication	<a href="#">Journal of Arthroplasty, vol. 30, 2015</a>

**Methods** A US tertiary care institution's joint registry was used to identify the acetabular component position of 7,040 patients who reported dislocation within six months of THA by measuring AP radiographs.

**Results** 2.1% of patients reported dislocation. There were no significant differences between the number of dislocations and position within the Lewinnek safe zone. However, dislocators <50 years old were found to be less active preoperatively compared to non-dislocators. Patients >70 years old also experienced a higher dislocation rate.

**Conclusions** Hip dislocation is multifactorial and acetabular component position alone is not protective against dislocation. No universal 'safe zone' exists regarding component position.



Comparison of Esposito et al's findings and Lewinnek's 'safe zone'<sup>1</sup>

## 6. The death of the Lewinnek 'Safe Zone'

**Title** Death of the Lewinnek "Safe Zone"

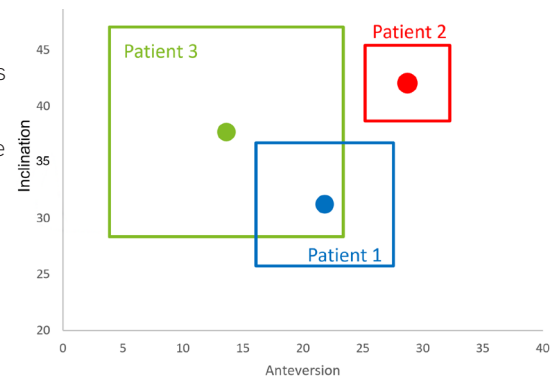
**Authors** Dorr LD, Callaghan JJ

**Publication** [Journal of Arthroplasty, vol. 34, 2019 \(Editorial\)](#)

**Methods** Over the last four decades the 1978 study by Lewinnek et al has been cited in approximately 2,000 publications. Critical analysis of the study by today's standards identifies several significant limitations.

**Results** 33% of dislocations (3/9) fell within the proposed safe zone with the authors and surgeons quoted as recognising that dislocation after THA was multifactorial.

**Conclusions** The range of stable cup orientations is patient-specific. Individual spinopelvic mobility, functional pelvic and femoral positions should also be taken into consideration.



Example of patient-specific safe zones



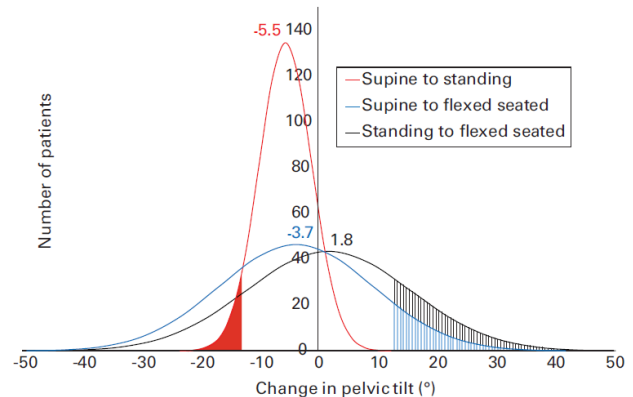
## 7. A natural evolution: functional orientation

Title	Variation in functional pelvic tilt in patients undergoing total hip arthroplasty
Authors	Pierrepont J, Hawdon G, Miles BP, O'Connor B, Baré J, Walter LR, Marel E, Solomon M, McMahon S, Shimmin AJ
Publication	<a href="#">The Bone &amp; Joint Journal, vol. 99-B, 2017</a>

**Methods** Pre-operative sagittal pelvic tilt was measured in 1517 THA patients. Pelvic tilt in supine, standing and flexed seated functional positions was measured. A pelvic rotation of  $\geq 13^\circ$  between positions was considered extreme, as it would result in a  $\geq 10^\circ$  change in functional acetabular anteversion

**Results** The mean sagittal pelvic rotation from supine to standing was  $-5.5^\circ$  ( $-21.8$ - $8.4$ ), from supine to flexed seated was  $-3.7^\circ$  ( $-48.3$ - $38.6$ ) and from standing to flexed seated was  $1.8^\circ$  ( $-51.8$ - $39.5$ ). In 17% of patients, the extent of sagittal pelvic rotation could lead to functional malorientation of the acetabular component.

**Conclusions** Pre-operative, functional evaluation is recommended as positional changes in pelvic tilt may lead to functionally malorientated cups



Positional changes in pelvic tilt

## 8. Predicting functional cup malorientation

**Title** Risk factors for increased sagittal pelvic motion causing unfavourable orientation of the acetabular component in patients undergoing total hip arthroplasty

**Authors** Langston J, Pierrepont J, Gu Y, Shimmin A

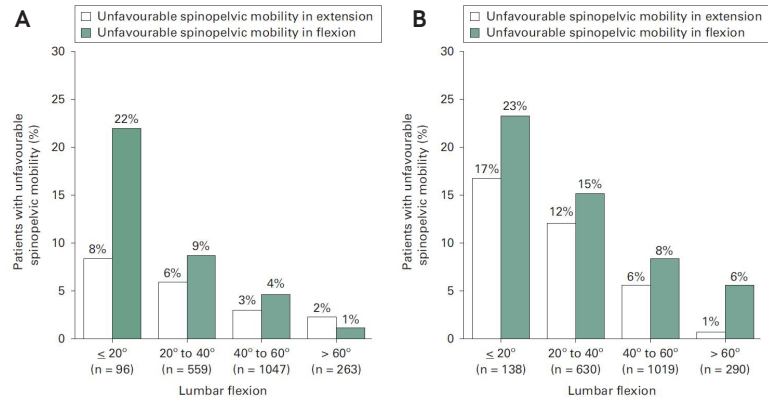
**Publication** [Bone & Joint Journal, vol. 100-B, 2018](#)

**Methods** 4,042 patients undergoing THA had lateral functional radiographs and a CT scan to determine changes in pelvic tilt (PT) from supine-to-standing and supine-to-flexed seated positions. A change in PT of  $\geq 13^\circ$  was deemed unfavourable as it alters functional cup anteversion by  $\geq 10^\circ$ .

**Results** Patients with increased risk of unfavourable pelvic mobility:

- Lumbar flexion (LF)  $\leq 20^\circ$
- Standing pelvic tilt (SPT)  $\leq -10^\circ$
- Women  $>75$

**Conclusions** Presence of one or more of the above parameters correlated with an increased incidence of unfavourable pelvic mobility. However, not all patients with unfavourable pelvic mobility display these risk factors, supporting the need for patient-specific preoperative planning for all patients undergoing THA.



Standing PT and unfavourable pelvic mobility. A) Men B) Women

## 9. Predicting instability

**Title** Total hip arthroplasty in the spinal deformity population: does degree of sagittal deformity affect rates of safe zone placement, instability, or revision?

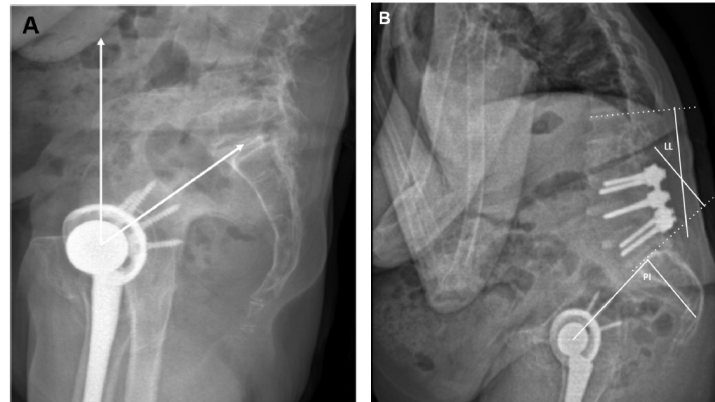
**Authors** DelSole EM, Vigdorichik JM, Schwarzkopf R, Errico TJ, Buckland AJ

**Publication** [Journal of Arthroplasty, vol. 32, 2017](#)

**Methods** 107 THA patients from a US tertiary care institution diagnosed with a sagittal spinal deformity (SSD) using ISSG criteria, had a comparison of standing and supine pelvic radiographs to evaluate dynamic changes in acetabular cup position. Parameters between dislocators and non-dislocators were compared.

**Results** THA dislocation rate was 8.0%, with a revision rate of 5.8% for instability. Patients with dislocations had a significantly increased standing pelvic tilt (p-value 0.05) and pelvic incidence - lumbar lordosis (PI-LL) mismatch (p-value 0.015).

**Conclusions** Surgeons should anticipate potential instability post-THA in the SSD population and adjust their surgical plan accordingly.



Measurements of a) spinopelvic tilt and b) PI-LL mismatch.

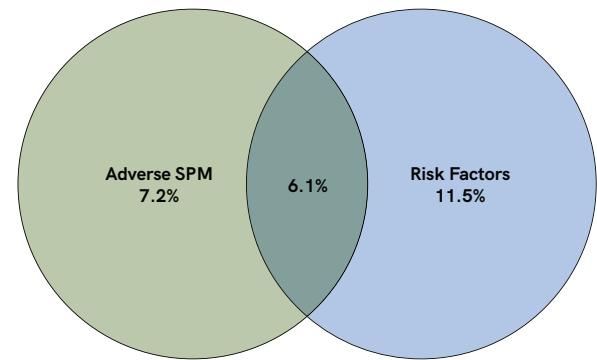
## 10. Risk factors for adverse spinopelvic mobility

Title	Prevalence of Risk Factors for Adverse Spinopelvic Mobility Among Patients Undergoing Total Hip Arthroplasty
Authors	Vigdorichik JM, Sharma AK, Madurawe CS, Pierrepont JW, Dennis DA, Shimmin AJ
Publication	<a href="#">J Arthroplasty 36 (2021) 2371-2378</a>

**Methods** The prevalence of adverse spinopelvic mobility (SPM) and spinopelvic risk factors were assessed in a multicenter series of 9414 primary THAs performed by 168 surgeons. Risk factors included a stiff lumbar spine (Lumbar Flexion  $<20^\circ$ ), standing posterior pelvic tilt  $\leq 10^\circ$ , and a severe sagittal spinal deformity (pelvic incidence minus lumbar lordosis mismatch  $\leq 20^\circ$ )

**Results** 17.6% of patients had one or more of the 3 risk factors. Of this sub-cohort, adverse SPM was present in 35% of patients with at least 1 risk factor, 47% with at least 2 risk factors, and 57% with all 3 risk factors.

**Conclusions** 13.3% of patients exhibited adverse SPM. 46% of these patients exhibited one or more of the 3 risk factors. These 3 risk factors are the best predictors of adverse SPM currently available but they are not all inclusive. The authors suggest pre-operative screening for adverse SPM in all patients undergoing THA.



**Percentage of THA patients who have adverse spinopelvic mobility (SPM) as a consequence of 3 key risk factors: large posterior pelvic tilt, severe sagittal spinal deformity and a stiff lumbar spine.**

## 10. Risk factors for adverse spinopelvic mobility (cont)

<b>Title</b>	High Prevalence of Spinopelvic Risk Factors in Patients with Postoperative Hip Dislocation
<b>Authors</b>	Huddleston JI, Madurawe CS, Vigdorichik JM, Lee GC, Jones TE, Dennis DA, Austin MS.
<b>Publication</b>	<a href="#">AAHKS 2020 (poster), Hip Society Members Meeting 2021</a>

**Methods** Spinopelvic risk factors in 48 primary THA patients with instability were compared to a control cohort of 4042 THA patients. Thresholds for “at risk” spinopelvic parameters were standing posterior Pelvic Tilt (PT)  $\leq -10^\circ$ , Lumbar Flexion (LF): LLstand - LLseated  $\leq -20^\circ$ , Pelvic Incidence (PI)  $\leq 41^\circ$ , Sagittal Spinal Deformity (SSD): PI - LLstand mismatch  $\geq 20^\circ$ .

**Results** There were significant differences in the proportion of patients exhibiting risk factors in the unstable cohort: standing PT: 52% vs 12%; lumbar flexion: 54% vs 6%; PI-LL mismatch: 21% vs 7%;  $p < 0.001$ .

75% of the dislocating patients had one or more of the 3 significant risk factors compared to only 18% of the control THA cohort representing a 4.1-fold increase.

71% of the dislocating patients had cup orientations within the traditional safe zone of  $40^\circ/20^\circ \pm 10^\circ$ .

**Conclusions** Excessive standing posterior PT, low lumbar flexion and severe SSD are more prevalent in unstable THAs. Pre-op screening for these parameters combined with appropriate planning and implant selection may help identify at risk patients and reduce dislocations.

“At risk” spinopelvic parameters	Prevalence		
	Dislocators (n = 48)	Controls (n = 4042)	P value (chi-squared test)
Large posterior standing PT	52% (n=25)	12% (n=503)	$p < 0.0001$
LF	54% (n=26)	6% (n=243)	$p < 0.0001$
PI	6% (n=3)	9% (n=318)	$p = 0.4532$
PI-LL Mismatch	21% (n=10)	7% (n=245)	$p < 0.0001$

## 11. Risk Factors for Prosthetic Impingement

**Title** The Effect of a Degenerative Spine and Adverse Pelvic Mobility on Prosthetic Impingement in Patients Undergoing Total Hip Arthroplasty

**Authors** Gu YM, Kim W, Pierrepont JW, Li Q, Shimmin AJ

**Publication** [J Arthroplasty 36 \(2021\) 2523-2529](#)

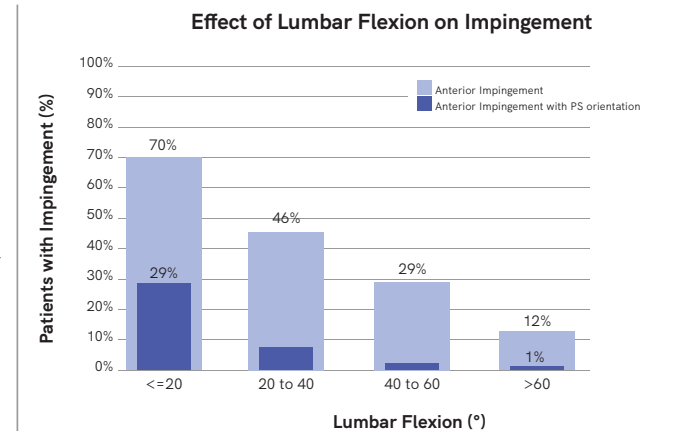
**Methods** Spinopelvic mobility parameters were investigated for association with impingement in 1592 patients undergoing THA between Jan 2018 and Dec 2019. Patients were evaluated for anterior and posterior impingement within traditional and patient-specific functional safe zones.

**Results** Anterior impingement was associated with a stiff spine, sagittal imbalance, and more anterior pelvic mobility from stand to flexed-seated.

Posterior impingement was associated with larger posterior pelvic mobility from supine-to-stand.

Impingement was reduced 3-fold when cup orientation was tailored to a patient's functional safe zone rather than a generic target.

**Conclusions** Patients with a degenerative spine and adverse pelvic mobility are likely to have unfavorable functional cup orientations, resulting in prosthetic impingement. Preoperative functional radiographic screening is recommended.



**A decrease in lumbar flexion (ie, a stiffer spine) was associated with an increase in anterior impingement.**

## 12. Relevance of flexed-seated radiographs for THA planning

Title	Sacral Slope Change from Standing to Relaxed-Seated Grossly Overpredicts the Presence of a Stiff Spine
Authors	Grammatopoulos G, Pierrepont JW, Madurawe CS, Innmann M, Shimmin AJ, Vigdorchik JM
Publication	<a href="#">AAHKS 2021 (Poster)</a>

**Methods** A multi-centre, consecutive series of 312 patients had standing, relaxed-seated and flexed-seated lateral radiographs prior to THA. Change in Sacral Slope from standing to relaxed seated positions ( $\Delta SS_{\text{standing} \rightarrow \text{relaxed-seated}}$ ) was determined. Lumbar flexion (LF) was defined as the difference in lumbar lordotic angle between standing and flexed-seated.  $LF \leq 20^\circ$  was considered a stiff spine. The predictive value of  $\Delta SS_{\text{standing} \rightarrow \text{relaxed-seated}} \leq 10^\circ$  for characterising a stiff spine was assessed.

**Results** A weak correlation between  $\Delta SS_{\text{standing} \rightarrow \text{relaxed-seated}}$  and LF was identified ( $r^2 = 0.13$ ). Of the 86 (28%) patients with  $\Delta SS_{\text{standing} \rightarrow \text{relaxed-seated}} \leq 10^\circ$ , only 13 (15%) had a stiff spine. The positive predictive value of  $\Delta SS_{\text{standing} \rightarrow \text{relaxed-seated}} \leq 10^\circ$  for identifying a stiff spine was 15%.

**Conclusions**  $\Delta SS_{\text{standing} \rightarrow \text{relaxed-seated}} \leq 10^\circ$  was only weakly correlated with a stiff spine. Utilising this simplified approach could lead to a 7x overprediction of patients with a stiff spine and an overprediction of patients with abnormal spinopelvic mobility, unnecessary use of dual mobility bearings and incorrect component alignment targets. The authors recommend the flexed-seated position to effectively assess a patient's spinopelvic mobility.

**Table 1: Positive and Negative Predictive Value**

<b>N = 312</b>	<b>Stiff</b>	<b>Not Stiff</b>	<b>Predictive Value</b>
<b>Positive (<math>\Delta SS &lt; 10^\circ</math>)</b>	13	73	15%
<b>Negative (<math>\Delta SS &gt; 10^\circ</math>)</b>	6	220	97%

### 13. Only 19% of patients with a stiff spine have spinal implants

**Title** The Majority of Total Hip Arthroplasty Patients With a Stiff Spine Do Not Have an Instrumented Fusion

**Authors** Vigdorich JM, Sharma AK, Dennis DA, Walter LR, Pierrepont JW, Shimmin AJ

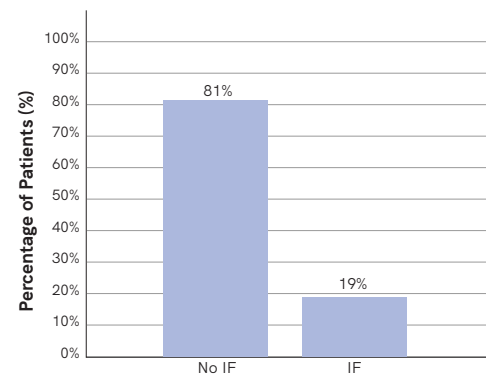
**Publication** [Journal of Arthroplasty 35 \(2020\) S252-S254](#)

**Methods** 6340 primary THA patients were reviewed for instrumented fusion (IF) of the lumbar spine. Stiff spine (SS) was classified by lumbar flexion (LF)  $\leq 20^\circ$ , and the percentage of patients with an IF and limited LF was determined.

**Results** 356 (6%) patients had a SS, and only 67 (19%) had an IF. Of the entire 6340 patients, 207 (3%) had an IF. Of these 207, only 67 (32%) had a stiff spine.

**Conclusions** The vast majority (81%) of THA patients with a SS do not have an IF. We recommend preoperative spinopelvic assessment of all patients undergoing THA, as only a minority of those with limited LF have an IF and may otherwise be overlooked.

**Percentage of patients with stiff spines (SS) having instrumented fusions.**



**81% of patients having a stiff spine do not have an IF.**



## 14. Predicting edge loading and squeaking

**Title** Functional orientation of the acetabular component in ceramic-on-ceramic total hip arthroplasty and its relevance to squeaking

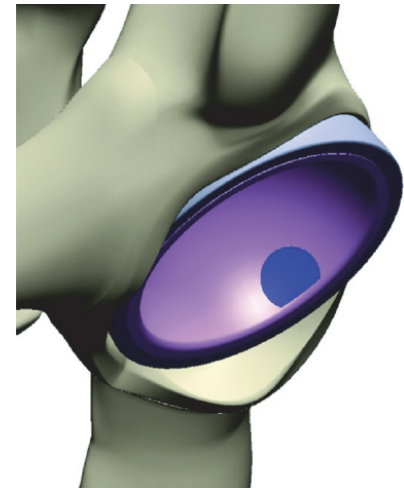
**Authors** Pierrepont JW, Feyen H, Miles BP, Young DA, Baré JV, Shimmin AJ

**Publication** [Bone & Joint Journal, vol. 98-B, 2016](#)

**Methods** 18 ceramic-on-ceramic (CoC) THA patients with reproducible squeaking during deep flexion were matched with a non-squeaking control group for implant type, supine cup orientation, femoral head size, ligament laxity, maximum hip flexion and BMI.

**Results** The squeaking group displayed a significantly larger change in pelvic tilt from stand to flexed seated (p-value 0.022). The mean functional anteversion of the cup when patients initiated rising from a seated position was significantly less in this group ( $8.1^\circ$ ) than in the control group ( $21.1^\circ$ ) (p-value 0.002).

**Conclusions** Individuals with a large anterior pelvic tilt during deep flexion might be more susceptible to posterior edge-loading and squeaking because of a significant decrease in the functional anteversion of the acetabular component.



Representation of edge-loading

## 15. When does bony vs prosthetic impingement occur?

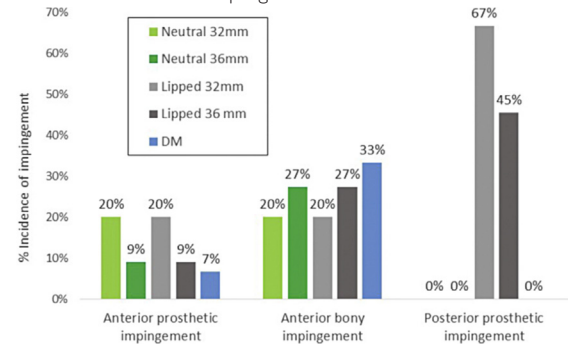
Title	Does Prosthetic or Bony Impingement Occur More Often in THA: A Dynamic Preoperative Analysis
Authors	Vigdorichik JM, Sharma AK, Madurawe CS, Elbuluk AM, Bare JV, Pierrepont JW
Publication	<a href="#">The Journal of Arthroplasty 35 (2020) S252-S254</a>

**Methods** 23 THA patients were planned using dynamic planning software. Cups were orientated at 45° inclination and 25° anteversion when standing, and the type and location of impingement was recorded during standard and extreme ranges of motion (ROM).

**Results** In standard ROM, flexion produced both prosthetic and bony impingement and extension resulted in prosthetic impingement in models with lipped liners. In extreme ROM, anterior impingement was 78% bony in 32-mm articulations, and 88% bony in 36-mm articulations. Posterior impingement was 65% prosthetic in 32-mm articulations, and 55% prosthetic in 36-mm articulations. Dual mobility cups showed the greatest risk of posterior prosthetic impingement in hyperextension (74%).

**Conclusions** In standard ROM, both bony and prosthetic impingement occurred in flexion, while prosthetic impingement occurred in extension with lipped liners. In hyperextension, prosthetic impingement was more common than bony impingement, and was exclusively the cause of impingement when a lip was used. In flexion, impingement was primarily bony with the use of a 36-mm head. The risk of posterior prosthetic impingement was greatest with dual mobility cups.

Standard ROM test impingement results.



**In extension, impingement was only observed for lipped liners and was exclusively prosthetic.**

## 16. The acetabulum: precise planning and execution

**Title** Patient-specific instrumentation improves the accuracy of acetabular component placement in total hip arthroplasty

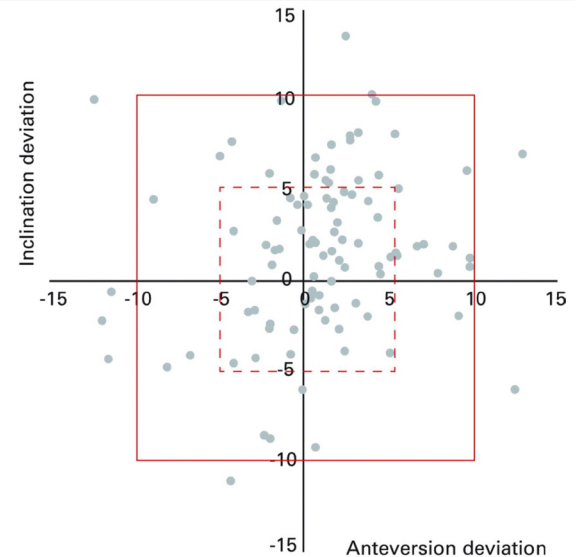
**Authors** Spencer-Gardner L, Pierrepont J, Topham M, Baré J, McMahon S, Shimmin AJ

**Publication** [Bone & Joint Journal, vol. 98-B, 2016](#)

**Methods** Accuracy of acetabular component placement utilising patient-specific instrumentation (PSI) was measured using postoperative CT scans of 100 consecutive patients.

**Results** The mean absolute deviation from the planned inclination and anteversion was  $3.9^\circ$  and  $3.6^\circ$ , respectively. In 91% of cases the planned target of  $\pm 10^\circ$  was achieved for both inclination and anteversion.

**Conclusions** Accurate placement of the planned acetabular component can be achieved using patient-specific guides and is superior to free hand and navigated techniques (62% and 81% within Lewinnek's safe zone respectively)<sup>1</sup>.



Position of the acetabular component within  $5^\circ$  and  $10^\circ$  of deviation from planned placement

<sup>1</sup>Moskal JT, Capps SG. Acetabular component positioning in total hip arthroplasty: an evidence-based analysis. J Arthroplasty 2011;26:1432-1437.

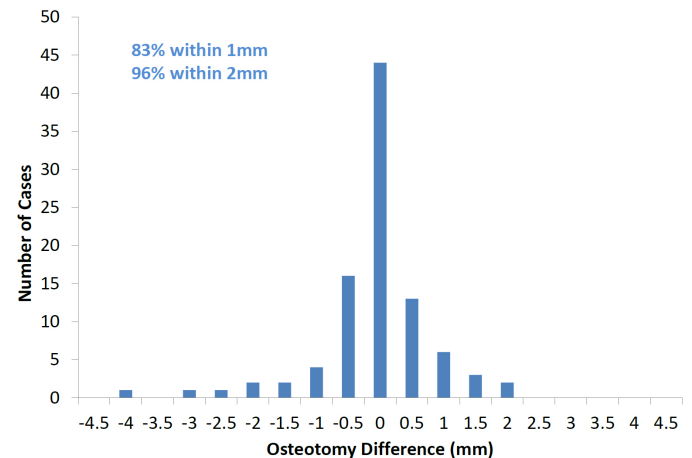
## 17. The femur: precise planning and execution

Title	Clinical Accuracy of a Patient Specific Femoral Neck Osteotomy Guide
Authors	Baré JV, Selim J, Kiraly Z, Stambouzou C, Pierrepont JW, McMahon S, Shimmin AJ
Publication	ISTA 2018 (Poster)

**Methods** 100 patients received a Trinity™/TriFitTS™ cementless THA through a posterior approach. The femoral osteotomy for all patients was performed using the patient specific instrument. The achieved level of osteotomy was confirmed postoperatively by registering a 3D model of the planned resected femur to the postoperative 2D radiograph.

**Results** The mean difference between the planned and achieved osteotomy level was 0.3mm, with a range of +2mm to -4.4mm.

**Conclusions** The patient specific osteotomy guide showed high level of accuracy, with 96% of cases within 2 mm and a maximum error of 4mm. By accurately controlling the level of osteotomy, a surgeon will have better control of leg length and offset.



## 18. OPS provides promising early results

**Title** Early results of the Corin Optimized Positioning System (OPS™): A registry analysis of 1728 THA patients

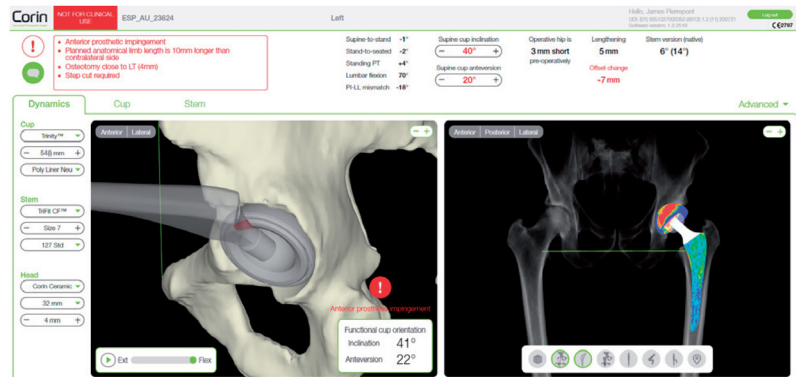
**Authors** Shimmin A, Madurawe C, Pierrepont J, Baré J, McMahon S

**Publication** Australian Orthopaedic Association Annual Scientific Meeting 2021

**Methods** A consecutive series of 1728 OPS™ THA patients from 3 surgeons from a single hospital were reviewed using the AOANJRR Adhoc reporting mechanism (No. 3092). 59% were posterior approach, 41% were Direct superior approach (DSA). Mean follow up was 30 months (range: 6 to 54)

**Results** 18 revisions (1.0%) were reported, including: 3 dislocations (0.2%), 9 femoral stem loosening (0.5%), 2 infections (0.1%), 3 periprosthetic fractures (0.2%), 1 prosthetic head breakage (0.1%)

**Conclusions** OPS™ Provides good early results with a low overall revision rate of 1%, and 0.2% for dislocation. All three dislocations reported may have been preventable with a more constrained bearing.



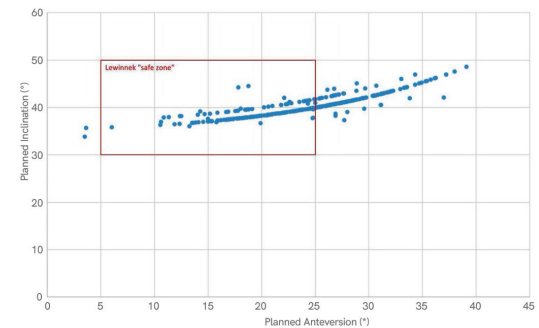
## 19. Low dislocation rates with OPS

Title	Low dislocation rates with the use of patient specific “Safe zones” in THA
Authors	Sharma AK, Cizmic Z, Dennis DA, Kreuzer SW, Miranda MA, Vigdorichik JM
Publication	<a href="#">Journal of Orthopaedics 27 (2021) 41-48</a>

**Methods** A retrospective review of 1500 consecutive primary THAs was performed. Inclination, anteversion, pelvic tilt, pelvic incidence, lumbar flexion, and dislocation rates were recorded.

**Results** 56% of dynamically planned cups were within the Lewinnek Safe Zone (LSZ) ( $p < 0.05$ ). 6/1500 (0.4%) of cups dislocated at two year follow-up, and all were within LSZ. Reasons for dislocation included: 1 for cup malpositioning outside of the OPS recommended safe-zone; 4 were high-risk patients with adverse spinopelvic mobility or sagittal spinal imbalance who should have received dual mobility bearings but did not.

**Conclusions** Optimal acetabular cup positioning using dynamic imaging differs significantly from historical target parameters but results in low rates of dislocation.



**56% of the dynamically planned acetabular cups were within the LSZ. Only 6/1500 (0.4%) of cups dislocated at two-year follow-up, and all dislocators were within the LSZ.**

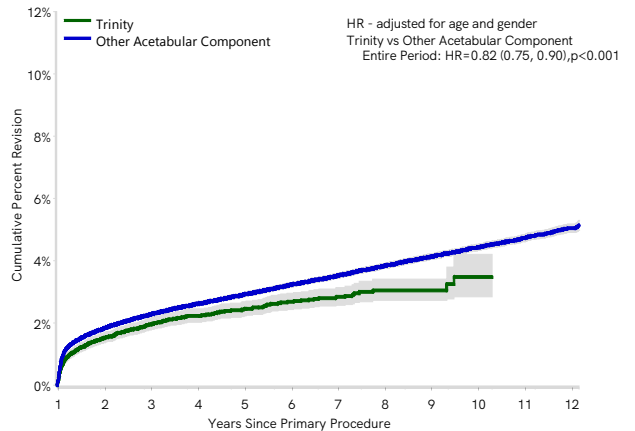
## 20. Proven results **Trinity™** cementless cup

Australia's **3rd most** used acetabular component in primary total conventional hip replacement<sup>1</sup>

**3.5% Cumulative Percent Revision (CPR) at 10 years.** 22% lower than other conventional hips at the equivalent time period for all diagnoses (3.5% vs 4.5%, HR = 0.82, 95% CI 0.75, 0.90, p<0.001).<sup>2</sup>

Since 2015, patients receiving Trinity cups were **29% less likely to be revised in the first 90 days** (HR = 0.71, 95% CI 0.61, 0.83, p<0.001) when adjusted for age, gender, BMI and ASA.<sup>2</sup>

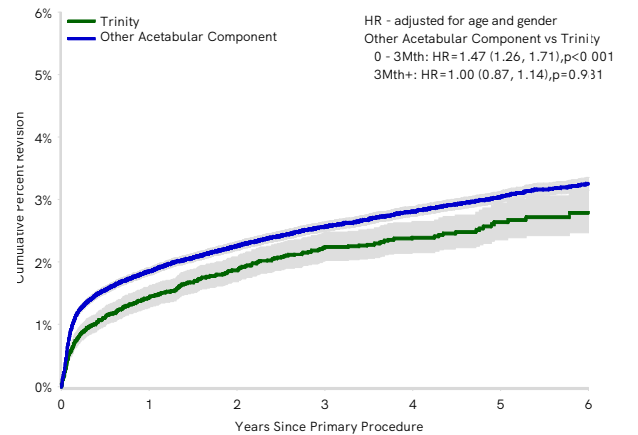
In the same time period, 20,000+ THAs with trinity cups have been implanted, with **over 65% of these having been performed with OPS.**<sup>3</sup>



Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs
Trinity	22989	18805	14985	11334	8024	5349
Other Acetabular Component	333278	297146	264771	230609	196876	164413

Number at Risk	6 Yrs	7 Yrs	8 Yrs	9 Yrs	10 Yrs	11 Yrs	12 Yrs
Trinity	3619	2200	1119	476	179	25	0
Other Acetabular Component	133212	105060	80004	57921	38575	21800	7975

CPR of Primary Total Conventional Hip Replacement by Acetabular Cup (All Diagnosis)



Number at Risk	0 Yr	1 Yr	2 Yrs	3 Yrs	4 Yrs	5 Yrs	6 Yrs
Trinity	20119	16005	12221	8611	5337	2714	1033
Other Acetabular Component	199801	167586	137718	106251	75451	46226	18547

CPR of Primary Total Conventional Hip Replacement Since 2015 by Acetabular Cup (All Diagnoses)

1. Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR), Table HT7. Hip, Knee & Shoulder Arthroplasty: 2021 Annual Report. Adelaide: AOA, 2021 [Accessed from: <https://aoanjrr.sahmri.com/annual-reports-2021>]
2. Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR), Ad hoc report, ID No.3356 for Corin Australia, Trinity Total Conventional Hip (Procedures from 1 September 1999 - 30 June 2021). Generated 13 August 2021. AOA, Adelaide. Disclaimer: The AOANJRR has taken every care to ensure that the data supplied are accurate but does not warrant that the data are error free and does not accept any liability for errors or omissions in the data
3. Data on file at Corin
4. Page 24 of 24

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