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Literature Summary

Title of Article: Polyethylene Wear Particles in Synovial Fluid After Total Knee Arthroplasty
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Citation: CORR, 410 (2003) p. 165-72
Product(s): Medial-Pivot, Various TKAs (Posterior-Stabilized, Cruciate-Retaining, and HXLPE)

Publication Highlights

- Polyethylene wear particle generation is an important aspect that influences mid- and long-term clinical TKA results**.**
- The purpose of this study was to assess and compare early-stage polyethylene wear particle characteristics in posterior-stabilized and medial-pivot total knee arthroplasty devices.
- **The medial-pivot (MP) design generated less wear particles than the posterior-stabilized (PS) prosthesis. Although not statistically significant, the MP also had smaller and rounder particles than the PS TKA.**
- This study represents an early follow-up period and additional long-term studies on polyethylene wear are needed.

Publication Summary

Methods

- Prospective clinical study of 22 knees (17 patients). Table 1 displays the devices used and the patient demographics**.**

Table 1. Types of TKA designs and materials and their associated demographics.

Prosthesis Design (# of Knees)	Implant Name	Mean Age
Posterior-Stabilized (11)	5 I/B II design (Zimmer) 6 Scorpio (Stryker)	63.8 ± 2.1
Medial-Pivot (11)	Advance Medial-Pivot (MicroPort)	67.0 ± 2.3

- Synovial fluid drawn 12-months post-op
  - After wear particle isolation, the measurements obtained were the total # of particles, the equivalent circle diameter (diameter of a circle with the same area), aspect ratio, and roundness.
- Pre-op and Post-op clinical and functional assessments conducted included: Hospital for Special Surgery Knee Score, Knee Society Score, # of steps per day, and pain, walking ability, and function rated on the University of California at Los Angeles 10-point rating system.
- Comparisons with time points between the PS and MP groups employed either a non-paired *t* test or a Mann-Whitney U test.

Results

Patient Preference

- **Statistically significant less wear particles were generated in the MP than the PS TKA (Table 2).**
- Although not statistically significant, the MP also had smaller and rounder particles than the PS TKA.

Table 2. Particulate measurements including the total number of particles, concentration, estimated circle diameter, aspect ratio, and roundness.

Prosthesis (# of Knees)	Total # of Particles	Concentration (/mL)	Estimated Circle Diameter (μm)	Aspect Ratio (length/width)	Roundness (perimeter^2/ [4π x area])
Posterior-Stabilized (11)	1160 ± 570 x10^5	123 ± 62 x10^5	0.78 ± 0.08	2.30 ± 0.22	2.52 ± 0.36
Medial-pivot (11)	**90.1 ± 29.5 x10^5**	**45.2 ± 24.1 x10^5**	0.67 ± 0.06	1.90 ± 0.16	1.80 ± 0.17

Study Limitations

- All implant groups had a small sample size and long-term analysis of polyethylene wear particulate is needed.
- The particulate size and detection is limited to the pore size of the filter used in the polyethylene isolation technique.

Overall Conclusion

- **"The medial pivot prosthesis generated less wear particles than the posterior-stabilized prosthesis, and these findings may have an impact on the incidence of osteolysis and aseptic loosening."**

Additional Notes: Clinical and Functional Results

Table 3. Clinical and functional results of the PS and MP TKAs.

	Hospital for Special Surgery Score		Knee Society Score		UCLA Clinical Score (0 worst-10 best)		Quantitative Steps per Day	
Prosthesis	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op	Pre-op	Post-op
PS	67.4±1.2*	93.1±0.9*	68.1±1.5*	93.5±0.8*	3.5±0.2*	4.5±0.2	3167±108*	3854±108
MP	34.2±3.7*	85.8±1.2*	18.2±1.0*	88.4±0.8*	2.8±0.1*	4.3±0.1	2729±84*	3729±97

***-** Indicates a significant difference between PS and MP groups