

The Precision Hip Experience
The Effect of Cement Mantle Geometry and A Centralized
Rough Surfaced Stem on Hip Arthroplasty Results at Long Term

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- I. **INTRODUCTION:** Long-term durability of cemented femoral components requires meticulous attention to 3 elements and 2 interfaces. They are: 1) **bone**, 2) **bone-cement interface**, 3) **cement**, 4) **cement-stem interface**, and 5) the **stem**.

A reasonable strategy to achieve better long-term results is to reduce the stress on the entire system. If the endosteal anatomy of the proximal femur could be characterized with sufficient accuracy it would be possible to obtain a cement mantle whose geometry would actually reduce stress. This would require a method to routinely place a stem with "cement-friendly" features in a neutral position in case after case. In such a stable system, strong stem-cement bonding, which also reduces cement stress, would be very desirable.

II. **METHODS: A 15-YEAR PROCESS**

A. Bone: Noble and co-workers proved that femoral canals differ in shape as size changes, i.e., non-proportional. Fortunately, these changes can be categorized into combinations of size/shape called "somatypes" or "canalprints". These contours offer insight into the design of cemented and ingrowth components, as well as instruments. The original 200+ specimens reported in 1985 has been expanded many times over into a more refined database.

B. Bone-cement Interface: Care is required in any cemented system to remove soft inadequate trabecular bone, but leave enough (2 mm.) subcortical cancellous bone for cement interdigitation and interlock. We reported an improvement in "A" cement technique from 48% to 72% with a later version of the Precision hip with an attached preformed (pressurizing) proximal cement mantle plus hypervolume cement technique (AAOS, 1997). The attached preformed mantle has been continued on the Definition hip, which succeeded the Precision system after a decade. Over-reliance on excessive reaming has been strongly discouraged.

C. Cement: An asymmetric cement mantle (3-7mm. proximal-medial 2 mm. lateral and mid stem and at least 1.5 mm distal) was shown to dramatically reduce stress on cement and interfaces. This was shown by Huiskies and co-workers to be as much as 90% in key areas. In all our studies this mantle has been routinely achieved. This is added to strict adherence to the details of proper cement technique and porosity reduction.

D. Stem-Cement Interface: In a stable cemented stem, permanent bonding to cement is desirable to further reduce stress. Buchelow, et al, investigated bonding characteristics of various interfaces. On that basis a surface roughness of 400 μ in. is present on the proximal 1/3rd of the original Precision and successor hips (Precision Strata and Definition) and 25 μ in. on the remaining "satin" finish. A small roughened area is present distally on the latter hips. The single digit roughness which proves fatal to stems characterized by a history of sinking in the cement, would be of no value in achieving permanent bonding of a stable stem.

E. Stem: Features that had been known to reduce cement stress (increased lateral bulk, rounded corner, and anatomic offset) were incorporated into the original Precision hip and continued forward. What distinguished this system was the introduction of performed PMMA centralizers, now routine in all cemented stems. A proximal ring centralizer was introduced in 1986 and replaced with the introduction of an attached preformed mantle 5 years later. Neutral positions of 97-100% have been noted in various reports.

III. RESULTS: 139 Precision THR in 130 patients followed average 119 months (112-124). Average age 65, 79/130 female, OA most common diagnosis.

Clinical -

12 point Charnley Pain/Walk = Preop 4.4 Postop 11.8

Radiographic -

$\pm 2^\circ$ neutral = 136/139

Desired cement mantle -

Proximal 139/139

Distal 137/139

Broken Centralizer -

Proximal 1/139

Distal 4/139

Loosening at 10 years = 2/139 (1.4%)

IV. Conclusion: Centralization of a stem surfaced for permanent bonding, in a stress reducing cement mantle geometry is reproducible and is an effective strategy to promote improved long-term results. Attention to the details of bone preparation and cement technique is still required.