Introduction: A large body of the orthopaedic literature indicates that the cement mantle surrounding the femoral component of a cemented total hip arthroplasty should be at least 2 mm thick. Another concept, introduced in the early seventies and is still in use in France, consists of implanting a canal filling femoral component line-to-line associated with a thin cement mantle. This principle that has provided excellent long term clinical and radiologic results is called the “French paradox” [1]. An explanation to this phenomenon has been recently provided by in vitro studies demonstrating that a thin cement mantle in conjunction with a canal filling stem was supported mainly by cortical bone and was subjected to low stresses [2,3]. The aim of the current study was to evaluate the in vivo migration patterns of a consecutive series of polished femoral components cemented line-to-line using EBRA-FCA [4].

Materials and Methods: Between January 1988 and December 1989, 164 primary total hip arthroplasties were performed in 155 patients by the two seniors of us. The mean age at the time of the index arthroplasty was 63.8 ± 11.6 years (median 62.5; interquartile ranges, 56.5 to 72.3). A single design prosthesis was used combining an all-polyethylene socket and a 22.2 mm femoral head. The monoblock double tapered (5.2°) femoral component made of 316-L stainless steel had a highly polished surface (Ra = 0.04 μm) and a quadrangular section (Kerboull® MKIII, Stryker). The femoral preparation included removal of diaphyseal cancellous bone to obtain primary rotational stability of the stem prior to the line-to-line cementation. For each patients, all available AP radiographs of the pelvis were digitized (Vidar Sierra Plus, Vidar System Corporation, Herndon, Virginia) and linked to an IMB-compatible computer. The EBRA-FCA software is a validated method designed to assess migration of a femoral component through comparable pairs of radiographs (Fig. 1). The accuracy of this method has been reported to be better than ± 1.5 mm (95% percentile), with a specificity of 100% and a sensitivity of 78% for the detection of migration of more than 1.0 mm, using RSA as the gold standard [4].

Results: At the minimum 15-year follow-up, 73 patients (77 hips) were still alive and had not been revised as at a mean of 17.3 ± 0.8 years (15-18 years), 8 patients (8 hips) had been revised for high polyethylene wear associated with periacetabular osteolysis, 66 patients (69 hips) were deceased, and 8 patients (10 hips) were lost to follow-up. Among the 8 revision procedures, the femoral component was loose in 3 hips.

A total of 1689 radiographs (mean 10.3 per hip) were digitized. Of these, 263 (15.6%) were excluded by the software since they did not meet the standards for comparability. Therefore, using EBRA-FCA, the length of follow-up of the whole series was significantly lower than the full observation period (Wilcoxon rank-sum test, p < 0.0001). No migration curve could be obtained for 22 of the 164 femoral components (13.4%).

At the last follow-up, the mean subsidence of the entire series was 0.63 ± 0.49 mm (median of 0.61 mm; range 0 to 1.94 mm). When using a 1.5 mm threshold (accuracy of the EBRA-FCA method) for subsidence, 4 of the 142 stems with adequate EBRA-FCA data were considered to have migrated. Using a threshold of 2 mm for subsidence, none of the 142 stems were considered to have migrated. The patterns of migration were calculated every 2 years giving 9 intervals. The results are summarized in Figure 2 and Table 1. The evolution of subsidence during the whole follow-up period remained below 1.5 mm.

Discussion: To the best of the authors’ knowledge, the migration patterns of a stem cemented according to the “French paradox” principles has never been assessed using an accurate and precise method. The main advantage of EBRA-FCA is that the variability of measured parameters is reduced by using only comparable radiographs, increasing the validity of our data. Mean subsidence of this quadrangular highly polished femoral component remained below the accuracy of the method (± 1.5 mm) throughout the entire follow-up period. Of the 142 hips analyzed, only four (2.8%) had subsided of more than 1.5 mm and none more than 2 mm.

In conclusion, this study demonstrates that contrary to other cemented femoral components that have provided excellent survival in the long term frequently associated with stem subsidence, a highly polished cemented double tapered femoral component with a quadrangular cross-section cemented line to line does not subside up to 18-year follow-up.