Proximal Femoral Radiolucent Lines in Dual Tapered Uncemented Stems: Do they Predict Loosening? Does a Collar Prevent them?

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INTRODUCTION: Fully coated dual tapered stems have proven to be a successful implant for non-cemented total hip arthroplasty. The geometry of the stem allows for ease of insertion through the direct anterior approach. For this reason, the stem has become very popular among hip surgeons using the direct anterior approach. A not uncommon radiographic finding on follow-up radiographs are proximal radiolucent lines in Gruen Zones one and seven representing a lack of osteointegration in the proximal region of the implant. The purpose of this study is to identify the incidence of this phenomena, identify if this predicts aseptic loosening, and compare the occurrence of this phenomena in non-collared versus collared dual tapered stems.

METHODS:

A consecutive series of 433 non-collared dual tapered stems was compared to a consecutive series of 494 collared dual tapered stems evaluating the postoperative radiographs of both implants at a minimum of one year out to identify the lack of osteointegration in the proximal femur. The operations were performed by one surgeon. After removing patients with lack of radiographic follow up of one year, a series of 386 non-collared dual tapered stems was compared to series of 383 collared dual tapered stems of similar design. Patient demographics of the two groups included ages, sex, side, and BMI and femoral implant offset and implant size.

	Non-Collared Dual Taper	Collared Dual Tapered	P Value
Average Age	67.6 (27 to 92)	64 (39 to 93)	P= 0.74
Sex (F:M)	234:152	286:97	P **<0.0001**
Side (L:R)	177:209	178: 205	P = 0.86
BMI	28.3 (18-50)	27.8 (16-54)	P = 0.41

Postoperative radiographs were evaluated for evidence of radiolucent lines in Zones 1 and 7, implant alignment, DORR ratio, and Flare Index. Univariate and multivariate analyses was performed. Statistical significance P < 0.05.

RESULTS:

A total of 769 hips were evaluated; 386 Non collared and 383 Collared. The average follow up was 4.6 years (range, 1 to 16). Radiolucent lines in both Zones 1 and 7 were identified in 66 (8.6%) patients in total, 47 (12%) non-collared hips and 19 (5%) Collared hips P < 0.0001. Four stems in the non-collared were revised for aseptic loosening. One stem in the collared group is symptomatic and is considered loose. The surgeon feels it is worth revising but the patient will not acquiesce to revision. Males composed 17.4% with Zone 1 and 7 radiolucent lines females with 5.9% P<0.0001. High Offset stems had 22% incidence of proximal radiolucent lines versus standard stem with 8.2% P = 0.003.

	Proximal Radiolucent lines N=66	No Proximal Radiolucent lines N= 703	P Value
BMI	28 (21-45)	28(16-54)	0.66
Flare Index	2.92 (2.27-4.70)	3.20 (1.26 – 5.30)	0.21
Dorr Ratio	O.35 (0.21-0.48)	0.36 (0.21 – 0.79)	0.07
High Offset: Standard Offset	13:53	60:643	**0.003**
Female: Male	29:37	491:212	**0.0001**
Left: Right	29:37	326:377	0.70
Collared/ Non-Collared	19/47	364/339	**0.0001**

Bivariate Analyses

Using bivariate analyses, no difference was seen in Left to Right ratio, Flare index, or BMI. Dorr Ratio for hips with radiolucent lines trended toward a smaller ratio but this was not statistically significant. Multivariate regression analyses demonstrated a statistically significant difference with Collared Stems (OR 0.41 (95% Confidence (0.23-0.73), and Female sex OR 0.33(95% Confidence (0.17 to 0.62) (P = 0.001).

	Odds Ratio	95% Confidence interval	P Value
Collar	0.41	0.23 – 0.72	**0.002**
Female	0.33	0.17 – 0.62	**0.001**
Stem size	0.99	0.78 – 1.09	0.78
High offset	1.22	0.96 – 2.54	0.51
Dorr Ratio	0.16	0.002 -10.9	0.40
Stem Position	0.83	0.52 – 1.33	0.43

BMI	0.99	0.94 – 1.03	0.78

Multivariate analyses

Stem size, DORR ration, Stem position (Varus, Valgus, Neutral), Stem offset, and BMI did not show statistical significance with multivariate analyses.

DISCUSSION AND CONCLUSION: Lack of proximal osteointegration was a common finding postoperatively at an average of 4.6 years. This did not predict implant failure. Of those with radiolucent lines of Zone 1 and 7 (66 hips), only 5 (7.5%) have been revised for aseptic loosening and 1 (1.5%) is considered loose but not wanting revisions. Female sex and Calcar Collar demonstrated protection against proximal radiolucent lines. High offset stems demonstrated a greater incidence by bivariate analyses of developing proximal radiolucent lines, but this did not bear out with multivariable regression analyses. No effect was seen by stem size, DORR ratio, Flare Index, or stem position.