Predictive Value of Cement Restrictor Size for Femoral Stem Selection in Cemented Total Hip Replacement (THR)

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BACKGROUND

Total hip replacement (THR) provides rapid and definitive improvement in pain and function for displaced femoral neck fractures in active elderly patients or end-stage osteoarthritis [1, 2]. In cemented THR, a smooth-surfaced femoral stem is fixed using bone cement, which interlocks mechanically with the surrounding bone [3-5]. A cement restrictor is inserted approximately 1 cm below the prosthesis to prevent distal cement leakage and ensure optimal pressurization [6, 7].

Three main types of restrictors exist – universal, press-fit, and expandable, with press-fit designs most widely used due to their reliability [8].

Despite their routine use, no studies have explored whether restrictor size correlates with femoral stem size. Establishing such a relationship may support intraoperative planning, reduce trialing errors, and improve operating-theatre efficiency.

OBJECTIVES

Primary Objective:

To evaluate the correlation between cement restrictor size and femoral stem size in cemented total hip arthroplasty (THR).

Secondary Objectives:

To assess relationships between femoral stem size, acetabular cup size, and femoral head size, with the goal of improving intraoperative implant selection and reducing trialing time.

METHODOLOGY

Study Design:

Retrospective cohort study of patients who underwent cemented or hybrid THR between Oct 2022 and Oct 2024 at a district general hospital.

Data Collection:

Recorded variables included cement restrictor size (8–14 mm), femoral stem type and offset (25.5–50 mm), stem length (115–220 mm), acetabular cup size (40–60 mm), and femoral head size (28–32 mm). Uncemented or unsuccessful THRs and cases with missing data were excluded.

Statistical Analysis:

Analyses were performed using SPSS v27. Spearman's rank and chi-square tests assessed correlations between implant characteristics; t-tests and z-tests compared group differences. Statistical significance was set at $p < 0.05$.

RESULTS

A total of **297** patients met our criteria and were subsequently included in our analysis. - Females: 202, Males: 95, range of 32-94 years of age and Hybrid THR: 20, Cemented THR: 277

Correlation between Cement restrictor size and Femoral stem size

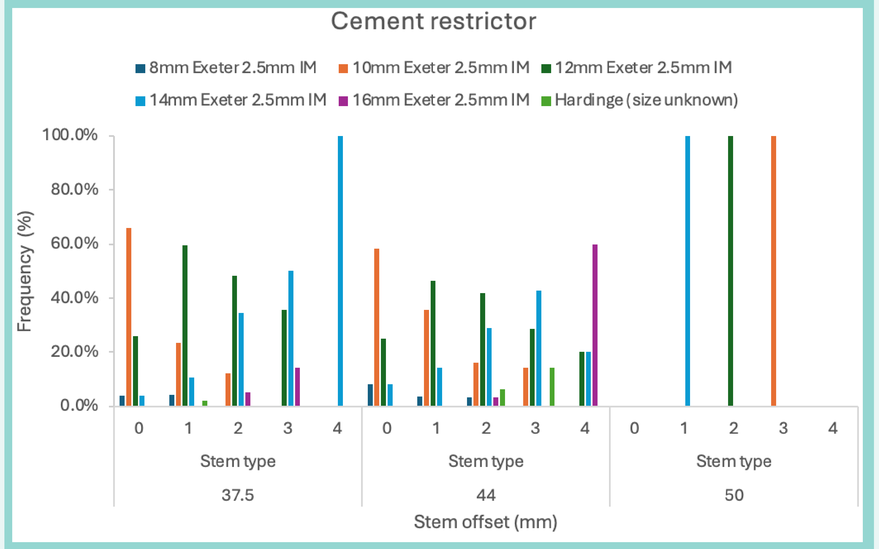

Figure 1: Graph comparing frequency of different cement restrictors used with various stem types and their offsets.

In the 37.5 mm offset group, restrictor sizes 10, 12, and 14 were associated with femoral stem sizes 0 (65%), 1 (60%), and 2–3 (80%), respectively. In the 44 mm offset group, restrictor size 12 was linked to stem size 1 in 90% of cases, while size 14 corresponded with stem sizes 2–3 in 70%. A consistent positive correlation was found between restrictor and stem size, except in the 50 mm offset group, which showed a negative correlation. All correlations were statistically significant ($p < 0.001$).

Correlation between Acetabular cup size and Femoral stem type

Acetabular cup size showed no significant association with femoral stem type within individual offset groups. The weak overall correlation likely reflects sample size rather than a true clinical relationship. Further analysis is needed to confirm these findings.

Correlation between Head size and Femoral stem type

Significant correlations were found at 37.5 mm and 44 mm offsets, with no correlation at 50 mm. Overall, a moderate positive relationship was observed, though limited data at higher offsets may have affected results.

DISCUSSION

This retrospective study demonstrated a strong positive correlation between cement restrictor size and femoral stem type across most offsets, except at 50 mm where the small sample size limits interpretation. The consistency of this finding supports the use of restrictor size as a potential intraoperative predictor of stem selection.

Previous work has linked demographic factors—such as age, gender, height, and weight—with stem size through preoperative templating [9, 10]. However, intraoperative decisions often depend on canal preparation and surgical judgment [11, 12]. Our results suggest that cement restrictor size, determined early during canal preparation, could provide a quick, objective reference for stem selection, improving efficiency and reducing trialing time.

Weak correlations between acetabular cup and stem size indicate largely independent sizing decisions, while moderate correlations between head and stem size reflect the need for coordinated implant planning to maintain leg length and soft-tissue balance.

Limitations include the single-centre, retrospective design and small subgroup sizes, particularly at the 50 mm offset. Nonetheless, this real-world variability enhances ecological validity. Future multicentre prospective studies should validate these associations and support evidence-based refinements in cemented THR practice.

CONCLUSION

Cement restrictor size demonstrates a significant correlation with femoral stem type in cemented THR, indicating its potential as a simple intraoperative guide for predicting stem dimensions. This may improve efficiency, reduce trialing errors, and streamline inventory management.

Secondary analyses showed weak associations with acetabular cup size and moderate correlations with femoral head size, underscoring the need for coordinated implant planning to maintain biomechanical balance.

Overall, incorporating restrictor–stem relationships into clinical practice could enhance procedural efficiency and consistency, particularly in high-volume or resource-limited settings.

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