

FACTORS AFFECTING THE CEMENT PENETRATION OF A HIP RESURFACING IMPLANT: AN IN-VITRO STUDY

¹ Ralph Howald, ² Uldis Kesteris, MD ¹ Ralf Klabunde
¹ Zimmer GmbH, Winterthur, Switzerland, email: ralph.howald@zimmer.com
² University Hospital Lund, Sweden

INTRODUCTION

Hip resurfacing is increasingly used in orthopedic arthroplasty. In order to plan and conduct the implantation properly, the operating surgeon needs to know how the cementing technique will influence the cement penetration. Breusch et al. [1] quantified the cement penetration in a conventional hip stem and Morberg et al. [2] investigated the cement-bone-interface histologically. However, no information could be found about cement penetration in hip resurfacing prostheses.

OBJECTIVES

Determine the influence of the following parameters on cement penetration: use of jet lavage, type of cement, and the standing period of the cement.

MATERIALS AND METHODS

The Durom™ Hip Resurfacing implant (Zimmer GmbH, Switzerland) and nine fresh frozen paired whole cadaver femora (mean 47 years, range 26 to 66 years) were used in this study. The standard case was the use of jet lavage for cleaning the prepared bone and Simplex® cement (Stryker Orthopaedics, USA) with a three minute standing time. The femora were divided into three paired groups: (A) compared the use of jet lavage to no jet lavage, (B) compared the two low viscosity cements SULCEM™-3 (Zimmer GmbH, Switzerland) and Simplex®, and (C) a 1.5 minute standing time was compared to a 3 minute standing time. All 18 implantations were conducted within a two day period by an experienced surgeon using the standard OR procedures.

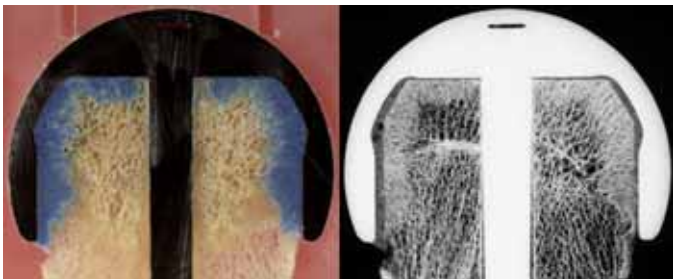


Fig. 1. Section cut of a femoral head (left) and contact x-ray image (right)

A single 2.6 mm thick slice was taken out of the center of each head using a precision diamond blade band saw. Contact x-ray images were then generated using a cabinet x-ray system (Fig. 1). After digitizing the images, computer based measurements were made using Matlab routines. The following measurements were taken: cement penetration *ratio* (penetration area divided by the bone area enclosed by the implant) and mean cement penetration *depth*. The results within each group were compared using a paired t-test. However, since the sample size was only three, the results only indicate tendencies.

RESULTS AND DISCUSSION

Leaving out jet lavage decreased the mean cement penetration *ratio* by 62% ($p = 0.018$), whereas the mean penetration *depth* decreased by 65% ($p = 0.024$). No significant differences were seen between SULCEM-3 and Surgical Simplex when comparing the cement penetration *ratio* ($p = 0.71$) and *depth* ($p = 0.57$). Applying the cement after a standing time of 1.5 minutes instead of 3 minutes resulted in a lower penetration ratio and depth in all cases. However, the results were not significant ($p = 0.15$, $p = 0.16$) (Fig. 2).

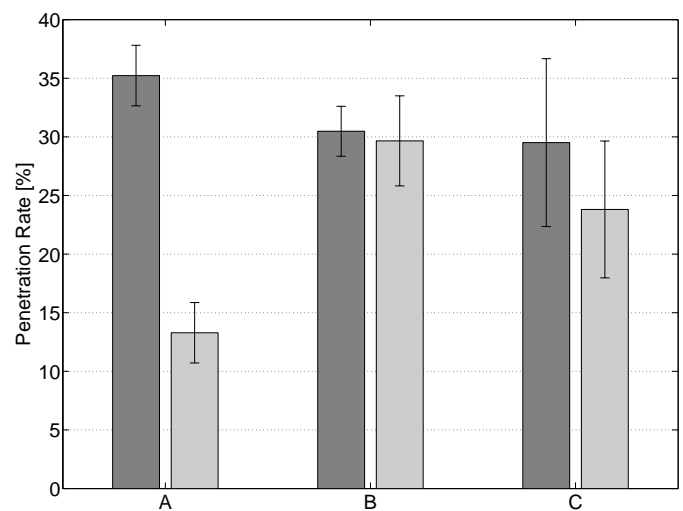


Fig. 2: Comparison of the penetration ratio: (A) Jet Lavage yes vs. no, (B) Simplex® vs. SULCEM™-3, (C) 3 min. vs. 1.5 min. standing period

CONCLUSION

Using jet lavage or increasing the standing time of the cement to 3 min. has the tendency to increase the cement penetration, whereas no difference in cement penetration was found when different cement brands of comparable viscosity are used.

LITERATURE

1. Breusch SJ, et al. *Journal of Arthroplasty* **15**, no. 7, pp. 921-927, 2000
2. Morberg P, et al. *Journal of Arthroplasty* **16**, no. 8, pp. 1004-1009, 2001

ACKNOWLEDGEMENT:

The authors acknowledge the great support of the Biomechanics Group at the Technical University of Munich, Germany.