Journal of Orthopaedics 15 (2018) 190–195

Contents lists available at ScienceDirect

Journal of Orthopaedics

journal homepage: www.elsevier.com/locate/jor

Original Article

A long-term comparative study between two different designs of cemented stems: Distal-cylindrical versus distal-taper

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ARTICLE INFO

Keywords:
Highly cross-linked polyethylene
Cemented THA
Polyethylene wear
Stem design

ABSTRACT

Introduction: The aim of this study was to calculate the wear rate of highly cross-linked polyethylene (HXLPE) and investigate long-term clinical and radiographic outcomes related to two femoral stem designs, the distal-cylindrical (DC) and distal-taper (DT) stems.

Materials and methods: Outcomes for the DC and DT stems were evaluated in 110 patients, who underwent total hip arthroplasty using an HXLPE socket, over a 5-year follow-up period. There were 56 hips (53 patients) in the DC group and 60 hips (57 patients) in the DT group. Clinical outcomes were measured using the Japanese Orthopaedic Association (JOA) score and radiographic changes. Polyethylene wear rate was calculated using a computer software.

Results: The mean follow-up period was 135.7 and 124.0 months for the DC and DT groups, respectively. Both stem designs improved hip function. On radiographic assessment, osteolysis around the tip of the stem was more frequent in the DC than in the DT group. Three cases of aseptic loosening of the stem were identified in the DC group, and no cases were identified in the DT group. The 10-year stem survival, using aseptic loosening as the primary endpoint, was 94.1% and 100% for the DC and DT groups, respectively ($p = 0.06$). The polyethylene wear rate was comparable for both stem groups.

Conclusion: Better clinical outcomes were obtained with the DT stem than with the DC stem regardless of the equivalent polyethylene wear rate for the two designs. The DC shape of the stem may increase the risk of aseptic loosening.

1. Introduction

Total hip arthroplasty (THA) is considered a successful treatment for hip disability, improving pain and hip function. Cemented or cementless THAs are performed worldwide, with a 10-year survival of primary THA of about 90%.[1] Various cement types, cement techniques, implant designs, materials, and surgical procedures have been developed to improve the outcomes of cemented THA. Among these innovations, the design of the femoral stem is one of the most important factors for long-term survival of cemented stems.

The use of highly cross-linked polyethylene (HXLPE) can also improve outcomes, with the wear rate of HXLPE being 14% of that of conventional polyethylene (CPE).[2] At our institute, two different titanium alloy stem designs for cemented THA are used with HXLPE sockets. In a previous report, one of these stem designs, the distal-cylindrical (DC) stem, used with a CPE socket, was found to induce characteristic loosening of the stem, resulting in a high rate of aseptic loosening.[3] In contrast, good clinical and radiographic outcomes have been reported for a distal-taper (DT) stem used with an HXLPE socket.[4]

The main difference between the DC and DT stems is the shape of the distal portion of the stem. The DC stem has a proximal-taper and distal-cylindrical shape, while a DT stem has a distal-taper shape. Our aim in this study was to compare the clinical and radiographic outcomes for the two stems designs, DC and DT, used with an HXLPE socket over 10 years, and investigate whether the difference in the distal shape of the stem was sufficient to affect the polyethylene wear of the socket and outcomes of primary cemented THA.

2. Material and methods

After an institutional review board approval, we retrospectively evaluated the clinical and radiographic outcomes of primary THAs

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https://doi.org/10.1016/j.jor.2018.01.019
Received 11 October 2017; Accepted 13 January 2018

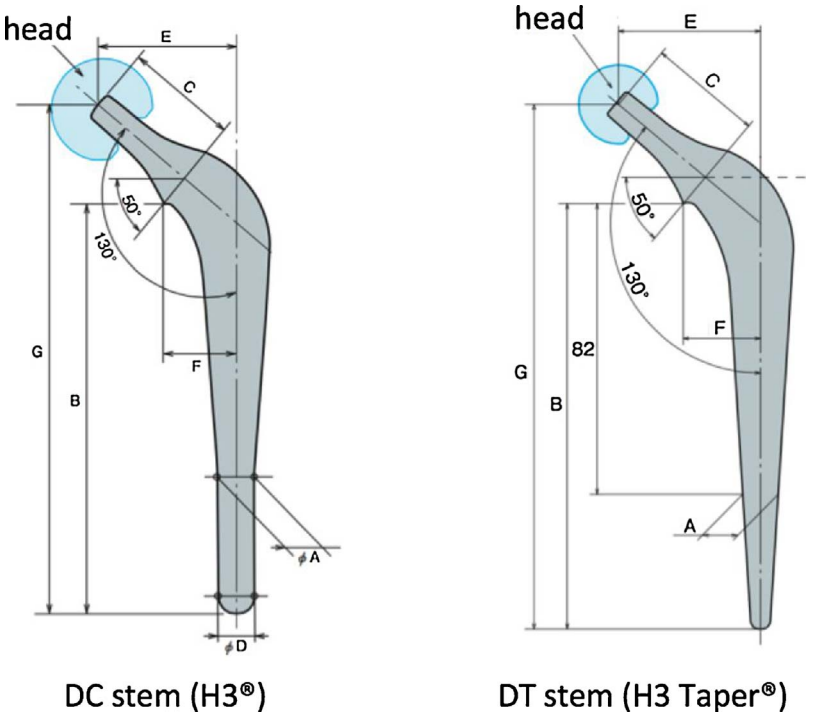

Fig. 1. The distal-cylindrical and distal-taper stem designs of the femoral head component.

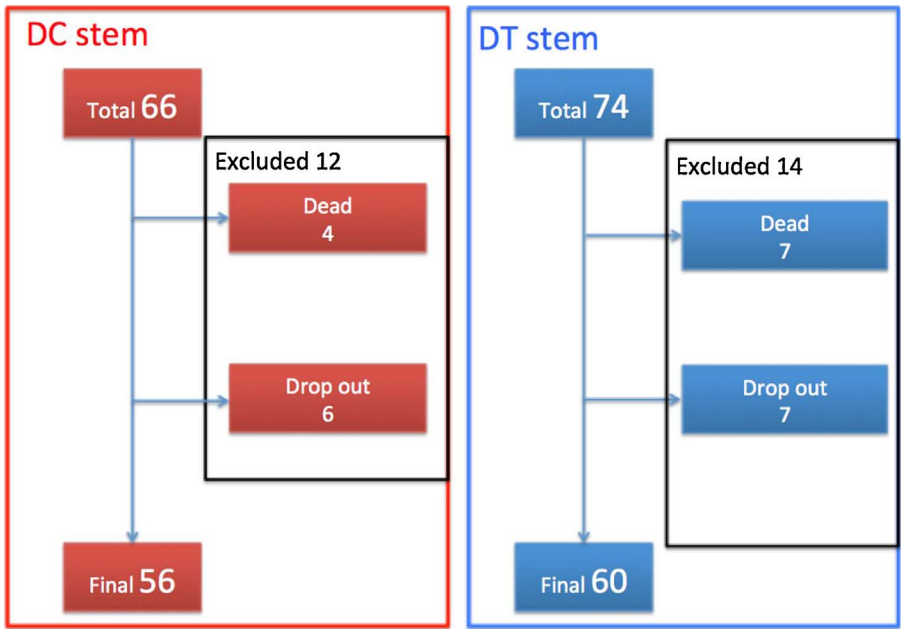

Fig. 2. Inclusion or exclusion flow diagram of cases treated using the DC and DT stem designs.

performed between 2000 and 2006. The DC stems were used from August 2000 to June 2004, and the DT stems from January 2004 to October 2006. The two stem designs are shown in Fig. 1. Patients with a 5-year follow-up period were eligible for enrollment. Prospective cases were screened to exclude (1) patients with insufficient follow-up data, (2) patients who received a subtrochanteric osteotomy in addition to primary THA, and (3) patients who were lost to follow-up or did not complete their follow-up due to death or transfer to another location. Among all THAs performed between 2000 and 2006, a DC stem was used in 66 hips and a DT stem in 74. After screening cases based on the exclusion criteria, 56 hips, contributed by 53 patients, formed the DC group, and 60 hips, contributed by 57 patients, formed the DT group. The allocation of cases is shown in Fig. 2.

Our overall follow-up rate was 82.9%. The mean age of patients at the time of surgery was 65.3 years (range, 45–82 years) in the DC group and 62.7 years (range, 44–81 years) in the DT group. Male patients contributed to 6 hips in the DC group and 7 hips in the DT group. The mean follow-up duration was 135.7 months (range, 60–186 months) for the DC group and 124.0 months (range, 65–150 months) for the DT group. The original diagnoses for THA in the DC group included secondary osteoarthritis (OA), 35 hips; primary OA, 18 hips; ankylosing spondylitis (AS), 1 hip; osteonecrosis (ON), 1 hip; and post-tuberculosis arthropathy, 1 hip. Diagnoses for the DT group were as follows: secondary OA, 44 hips; primary OA, 11 hips; ON, 2 hips; AS, 1 hip; post-traumatic arthropathy, 1 hip; and post-tuberculosis arthropathy, 1 hip. The mean body mass index (BMI) of the overall participants in both groups was 23.0 kg/m^2.

Self-report function was assessed using the Japanese Orthopaedic