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Is there any place for the variable angle proximal femoral plate? A case matched cohort study against the Dynamic Hip Screw system

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ABSTRACT

Introduction: The Variable angle Martin Plate (MP) is designed to offer patient-specific adaption for the treatment of intertrochanteric hip fractures. Its proposed benefits include optimization of lag screw placement, plate shaft congruence and reduced risk of failure. Often its use has been criticized as representing a poor reduction of the fracture. The purpose of this study was to assess for a poorer quality of reduction, and compare functional outcomes and mortality, using a MP to that of a fixed angle Dynamic Hip Screw (DHS) in a matched cohort of patients.

Methods: A retrospective review of a prospective fracture database system was undertaken between 1st January 2004 to 31st December 2013. MP patients were matched to a cohort of DHS patients. Outcomes measure were a quality of procedure score(QPS), 1-year mortality rates, reoperation rates, and Barthel Index functional outcome. Minimum follow up was 12 months.

Results: A total of 77 Martin Plate patients were identified and case matched. The mean pre- and post-op Neck Shaft Angle (NSA) in the MPs was significantly different (132.97 ± 7.78 Vs 126 ± 8.62; $p < 0.0001$). Conversely, the mean pre op DHS NSA and the mean post op NSA was not ($p = 0.397$). Mean Tip-Apex Distance (TAD) was significantly different between groups; MP mean 26.51 ± 9.09 mm vs DHS 23.50 ± 8.14 mm ($p = 0.023$). The QPS consisted of 4 variables. A significant inverse relationship between QPS and the incidence of construct related complications exists. TAD > 25 mm, and a change in AP NSA of >5° conveyed the greatest risk of complications. No difference occurred in complications, nor 12-month mortality.

Conclusions: No statistical difference was found in the quality of reduction between MP and DHS in this group of matched patients. QPS demonstrated a significant inverse correlation with implant-related complications. No significant difference was noted in the incidence of complications, Barthel Index functional scores, or 12-month mortality between implants.

A rationale exists regarding the use of MPs, particularly in patients with varus NSA. However, planning and adequate reduction are essential regardless of implant choice.

Introduction

Hip fractures globally have increased in incidence over the last 50 years, and have now reached a steady state increase in the UK and Americas [1]. They represent an increasing burden on hospital resources and finances due to the increasing complex medical, social and rehabilitation requirements [2]. In the UK alone, hip fractures account for 75,000 acute hospital admissions per annum, with a direct health expenditure of £2 billion [3]. Projections indicate that in excess of 100,000 hip fractures per annum will occur by the year 2020 [3]. Treatment of hip fractures revolves round a number of surgical implants, each with their own respective advantages and disadvantages. However, no internal fixation device can compensate for an inadequately reduced fracture [4].

The optimal treatment of proximal per-trochanteric femoral fractures remains the subject of much debate. The sliding hip compression screw concept has been used in the treatment of proximal femoral fractures since the 1970s—the modern incarnation is the Dynamic Hip Screw (DHS) system. This fixed angle device means that in varus or valgus femoral neck angles the ideal lag screw position is not always attainable, and the manufacturers claim that the dynamic worm gear system allows for varus and valgus correction. An increased tip apex distance (TAD) increases

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the risk of implant failure and cut out, quoted at 16–23% [5,6]. As a result, a variable angle device has been available since the 1990s, the Dynamic Martin Screw, or Martin plate (KLS Martin, Germany). The advantage of the Martin Plate (MP), is its ability to alter the neck shaft angle using a worm gear hinge system (Fig. 1). Theoretically this allows better adaptation of the plate as a lateral buttress, ensuring correct centering within the femoral head for the lag screw. This minimizes errors in the TAD, whilst maintaining the sliding barrel compression properties of the implant.

Despite widespread availability and use throughout Europe and North America there are very few publications, in English on the use of the MP [7]. To date, there has been no publications directly comparing the use of the fixed angle DHS to the variable angle MP system, and assessing for any superiority between the two systems. One study exists on MP use in intracapsular fractures only, but no literature exists as their use in extracapsular fractures of the hip [7].

In the current study we report the largest case matched cohort series comparing the use of a variable angle MP to a fixed angle DHS.

Senior Surgeons within our unit have been quotes as saying that "the only reason a MP is ever used is because the fracture has not been adequately reduced". The premise of this study therefore, was to answer the question as to whether an actual role for the MP exists or does its use simply represent failure to adequately reduce the hip fracture.

To answer this question, the primary aim of this study was to assess the quality of procedure for patients treat with either a MP or a DHS. Secondary outcomes were to assess the functional outcome for fracture neck of femur patients in terms of re-operation rate, complication rate and mortality between those treated with a MP versus a DHS.

Patients and method

Review of a prospectively maintained Fracture Outcomes Research Database (FORD) was used to identify all patients with fracture neck of femur, who underwent fixation using a Martin Plate between 1st January 2004 and 31st December 2013. Approval was granted by the Trauma and Orthopaedic Research Group (TORG) board members within the unit for undertaking the study.

The study centre is a regional trauma centre that contributes to a National Hip Fracture Database [2]. Annual governance demonstrates the unit performs in excess of 900 hip fracture operations per annum, reflecting high volume and experienced surgeon cohort in order to justify the study. A Population, Intervention, Control, Outcomes (*PICO*) method was adopted for the purposes of the study.

- Population—Femoral neck fractures
- Intervention—Martin Plate fixation
- Control—Dynamic Hip Screw fixation
- Outcome—Primary: Quality of procedure Score (QPS)

Secondary:

1. Complication rates
2. Functional score (Barthel Index)
3. Complication rates

From the same prospective database, matched patients were identified who had undergone fixed angle device fixation with a Dynamic Hip Screw fixation. These were used as a control group. Patients were matched by age ± 2years, ASA grade, AO fracture type and month of operation so that follow up time was equivalent. In the event that multiple matches were found using the database, consistency was achieved by taking the middle individual within the list of matches. Data was provided by the senior FORD research nurse (SMcD).

Patients were excluded if they had no intra-operative images saved to the Picture Archive Computer System (PACS), who had an incorrectly coded operative procedure, or who had a follow up time of less than 12 months. Similarly, all intracapsular fractures treated were excluded.

Operative technique was under spinal anaesthesia with a femoral nerve block. Reduction of the fracture was undertaken on a traction table. Following standard draping, a lateral skin incision was placed, with incision through Tensor Fascia Lata. Vastus lateralis is subsequently split, or elevated, and the guidewire passed into the head with image intensifier confirmation. The appropriate length of lag screw was measured and the lateral femoral cortex triple reamed. For all fractures a 4-hole plate and hip lag screw was applied. Decision to use a MP was the choice of senior operating surgeon in theatre, after closed reduction was performed on the traction table or after an attempt had been made to insert the guide wire using the 135° guide from the DHS kit. All

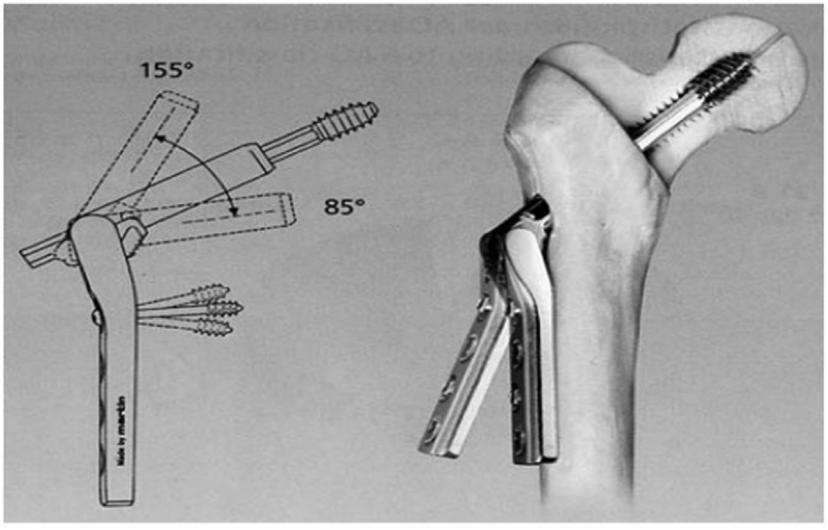

Fig. 1. The KLS Martin Plate uses a worm gear to vary the neck shaft angle between 85 and 155°, providing intraoperative flexibility, bone conformity and congruence as well as compression after reduction.

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