Low reoperation rate with the Medoff sliding plate

1 technical failure in 63 trochanteric hip fractures

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ABSTRACT – The Medoff sliding plate was designed to treat unstable intertrochanteric and subtrochanteric fractures. This plate has a dual sliding capability along both the femoral shaft and neck in order to improve bone coaptation, interfragment compression and hence load-sharing between bone and implant in hip fractures.

In a retrospective study of 63 patients (mean age 82 (51–98) years) with intertrochanteric (n 44) and high subtrochanteric fractures (n 19), we assessed the results with the Medoff sliding plate. All patients, except 1 lost to follow-up, were examined clinically and radiographically. 14 patients died within 1 year, and in the other, the mean follow-up was 15 (6–30) months. 1 technical failure occurred, leading to a single reoperation.

The low technical failure rate suggests that the Medoff sliding plate with combined compression modus is suitable for treating intertrochanteric and high subtrochanteric fractures.

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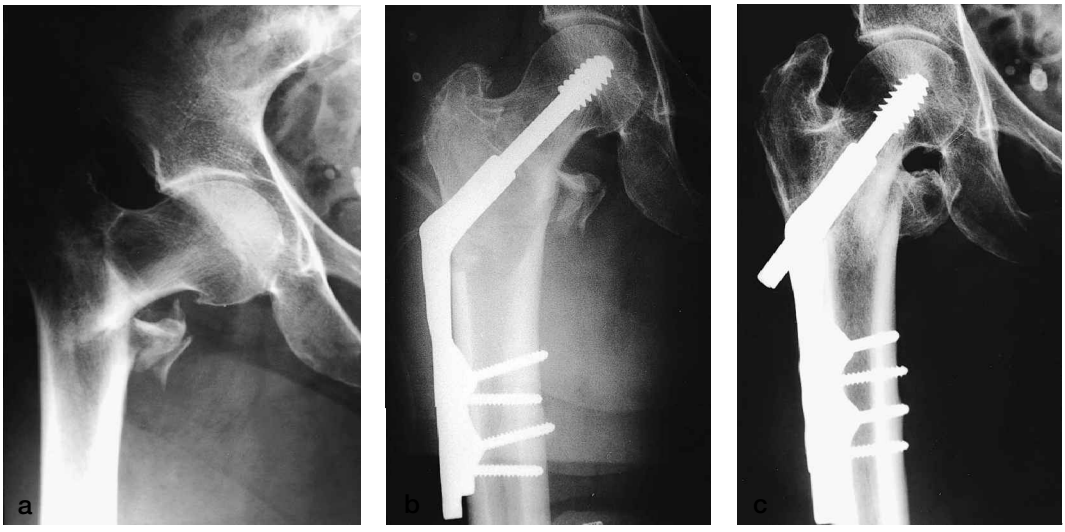
Today, there is a consensus that dynamic devices are better than static ones for treatment of intertrochanteric and subtrochanteric proximal femur fractures (Jensen et al. 1980, Möller et al. 1984, Zetterberg et al. 1985). Although dynamic screw-plate systems are the most widely used implants, the average associated rate of fixation or technical failure is about 10% in prospectively-followed unstable intertrochanteric fractures and even higher in subtrochanteric fractures (Davis et al. 1990, Leung et al. 1992, Desjardins et al. 1993).

To improve results of treatment of intertrochanteric and subtrochanteric femoral fractures, Medoff and Maes (1991) originally proposed a new device which allowed compression along the femoral shaft with an optional sliding mechanism along the neck of the femur for which he reported no technical failure. In his original presentation, sliding was used only along the 6-hole plate fixed to the femoral shaft. Lunsjö et al. (1996) insisted on the need for combined two-way compression. They reported 7 technical failures in 104 operations, using only compression along the shaft of the femur (Lunsjö et al. 1995), but only 1 technical failure in another series of 108 operations, when two-way compression was facilitated in intertrochanteric fractures (Lunsjö et al. 1996). In a prospective study of 94 patients, Olsson et al. (1997) described no revision with a simplified 4-hole plate.

We assessed the technical failure rate with the two-way compression device in the treatment of intertrochanteric and high subtrochanteric femoral fractures.

Patients and methods

The Medoff sliding plate (Medpac, Valencia, California, USA) is a modification of the standard DHS plate with the side plate replaced by 2 sliding components. This combination consists of an outer-tracked component affixed to the femur constraining an inner sliding element that holds a standard AO dynamic hip screw (Stratec Medical, Oberdorf, Switzerland). The side plate is curved, allowing bone screws to be placed biplanarly. This design permits bi-axial movement of the bone fragments. The sliding capacity of the Medoff



After injury (a), on day 1 (b) and final follow-up (c). Sliding occurs along the femoral shaft and femoral neck.

sliding plate is 2.5 cm.

From January 1996 to January 1999, we treated 63 consecutive patients (50 females) with an intertrochanteric or high subtrochanteric femoral fracture with the Medoff sliding plate. During this period, no other implant was used. The mean age of the patients was 82 (51–98) years with only 3 patients under 65 years. 55 patients were admitted to the hospital from their own home. Before injury, 41 patients were able to walk without any aid and 49 patients could walk more than 500 meters. The fracture was classified by the AO method (Müller et al. 1990). 8 fractures were classified as A1, 36 as A2 and 19 fractures as A3. Patients with fractures associated with tumors or with earlier surgery of the proximal femur on the same side were excluded. The evaluation of osteoporosis was performed using the Singh index (Singh et al. 1972). 25 hips had grade I, 21 hips grade II and 17 hips grade III. No hip had an index of IV or higher.

The operation was performed by 12 surgeons with varying experience. The surgical technique is identical to that of a standard dynamic hip screw. Overdistraction of the fracture must be avoided, otherwise the sliding capacity of the plate may be dissipated immediately after release of traction. The femoral neck is exposed by an antero-lateral arthrotomy and optionally the fracture reduction is completed with the help of a Hohmann retractor, introduced in the fracture area. A guide wire is inserted into the center of the femoral head, using the 135-degree guide. Screw length is measured, reaming is carried out and the sliding screw inserted. The screw hole is enlarged up to 2.5 cm distally. The barrel of the sliding element will otherwise impinge on the lateral cortex of the femoral shaft, preventing dynamic fracture compression. The Medoff sliding side plate is applied. Traction is released and the plate is fixed with 4.5 millimeter cortical screws. We used a 6-hole plate in 10 fractures, which reached the proximal screw of the plate medially. Routine prophylaxis against deep vein thrombosis was carried out with low-molecular-weight heparin, until full weight bearing had been achieved. Antibiotic prophylaxis was administered with a second-generation cephalosporin during 48 hours. Patients were mobilized the second day after the operation and full weight bearing allowed.

Diagnosis of pulmonary embolism or deep venous thrombosis was made on the basis of clinical suspicion and was confirmed by pulmonary scintigraphy or angiography, respectively.

48 of the 49 survivors were evaluated clinically and radiographically, with an average follow-up of 15 (6–30) months. The remaining patient could not be traced.

At final follow-up, domestic situation and walking ability were assessed. Clinical examination included range of motion of the hip, leg-length discrepancy and strength of the abductor muscle. Limb shortening was measured by comparing the

distance between the crista iliaca antero superioris and malleolus medialis of both legs. For assessment of abductor strength, the patient was placed on the side and asked to raise his leg. Results were classified according to the patient's ability to lift the leg "against resistance", "just lift the leg" or simply "unable" to do it and compared to the unoperated side.

Radiographic evaluations were done on the first day after surgery, at discharge from the hospital, at 6 and 12 weeks and at final follow-up (Figure). Technical failures, such as lag screw cut-out, implant breakage, loosening or breakdown of the implant or nonunion were analyzed. Minimal migration of the lag screw in the femoral head or slight varus angulation without penetration were not considered a technical failure. The degree of sliding of the device along the shaft and along the neck of the femur were measured by Lunsjö et al.'s method (1997). The amount of medial translation of the femoral shaft was measured as a percentage of the femoral diameter at the fracture site, at the level of the lesser trochanter.

For statistical analysis, we used contingency tables, Wilcoxon, Mann-Whitney and Kruskal-Wallis-tests. The significance level was set at 5%.

Results

The mean operating time was 120 (60–220) min. Additional cerclage wires for refixation of the greater trochanter were used in 21 patients. The mean duration of hospitalization was 22 (9–81) days. During the hospital stay, no postoperative infection, no deep venous thrombosis, but one pulmonary embolism (positive pulmonary scintigraphy) was diagnosed.

1 patient died during the hospital stay. 13 more patients died after a mean of 4 months (15 days–11 months) after hospital discharge. 1 patient had to be reoperated on 15 days after implantation of the Medoff plate, because of a subcutaneous hematoma, which had to be evacuated.

1 technical failure occurred. The sliding screw cut out in a 75-year-old woman with a severe Singh grade 1 osteoporosis. An osteosynthesis with a 95-degree angular plate was performed 18 days after the initial operation. The final outcome was good. In all 55 patients seen at the 12-week follow-up, the fracture had healed radiographically.

Mean amount and range (in parenthesis) of plate and lag screw slide (in mm) and medialization of femoral shaft (in %) for various types of fractures

	A1	A2	A3
Plate slide	4.09 (0–12)	9.15 (0–26)	13.95 (2–26)
Lag screw slide	4.63 (0–20)	11.73 (0–25)	10.12 (1–29)
Medialization	5.83 (0–31)	12.92 (0–36)	18.35 (0–70)

At final follow-up, 22 patients were still living in their own home. 14 patients could walk without aids. The differences between preoperative and postoperative home situations (chi-square $p<0.0001$) and walking abilities (chi-square $p<0.0001$) were significant.

There was no statistically significant difference in range of motion between the operated and unoperated sides. The limb on the operated side showed a mean shortening of 14 (0–35) mm. 16 patients could abduct the leg against resistance, 15 could hold the leg weight and 17 could not. On the non-operated side, 29 patients could lift the leg against resistance, 12 could lift the leg and 7 could not. The difference between the abductor strength of the operated versus the unoperated side was significant (chi-square $p= 0.01$)

There was no significant association between abductor weakness and leg-length shortening.

The side plate slid an average of 11 (0–27) mm. The average sliding of the lag screw was 11 (0–39) mm. Medialization of the femoral shaft at fracture level was 13 (0–70)% (Table).

Discussion

The mortality rate in our patients was identical to that in other series (Parker and Pryor 1996). Morbidity, as assessed by a change in the home situation and walking ability of our series, did not differ from those in others (Tonetti et al. 1997). Mortality and morbidity seem to depend more on med-

ical aspects than on types of fractures or stabilization techniques (Larsson et al. 1990).

The rate of complications and, in particular, the rate of reoperations are low with the Medoff sliding plate when the dual sliding principle is used . Our results confirm the findings of Lunsjö et al. (1996). The dual sliding ability of the Medoff sliding plate facilitates fracture impaction and load transfer to bone. Greater bone contact with the medial cortex increases load sharing, which improves healing and minimizes device failure (Olsson et al. 1998, Watson et al. 1998). The better dual sliding capacity is obvious when comparing implants which allow only single sliding along the femoral neck, such as gamma nails with reoperation rates between 2% and 12% (Bridle et al. 1991, Halder 1992, Leung et al. 1992). The low re-operation rate has a price, since most of our patients developed some shortening of the operated leg and insufficiency of the abductor muscles of their hip, which seems to be of minor clinical importance in view of the risk of a reoperation when a static device is used. The shortening of the leg results from the sliding mechanism of the Medoff sliding plate. The 45 degrees of angulation telescoping of 10 mm along the DHS barrel causes leg shortening of about 7 mm (leg shortening = shortening along the lag screw * cos 45°). Sliding of the Medoff sliding plate, however, results in an equal amount of leg shortening. We have found no previous reports on leg shortening and resulting abductor weakness with use of the Medoff plate.

The mean operating time was longer than in other series (Lunsjö et al. 1995, 1996). This was because not all surgeons were experienced in this series. Surgeons familiar with the technique of the DHS have no learning curve with the Medoff sliding plate in dual sliding.

We found that biaxial dynamic compression with the Medoff sliding plate is a reliable and consistent method of treatment. Results remain good, even when an inexperienced surgeon uses it, which is important since many of these fractures are treated by young colleagues. Immediate weight bearing is possible in all operated fractures, a great asset for patients who can not always collaborate and fully understand the concept of partial weight bearing, even if taught by a motivated physiotherapist.

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