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TWO-WAY COMPRESSION ALONG THE SHAFT AND THE NECK OF THE FEMUR WITH THE MEDOFF SLIDING PLATE

ONE-YEAR FOLLOW-UP OF 108 INTERTROCHANTERIC FRACTURES

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The Medoff sliding plate (MSP) is a new device used to treat intertrochanteric and subtrochanteric fractures. There are three options for sliding; either along the shaft or the neck of the femur, or a combination of both.

In a prospective series of 108 consecutive displaced intertrochanteric fractures we used combined dynamic compression. The patients were followed clinically and radiologically for one year. All fractures healed during the follow-up period. The only postoperative technical failure was one lag-screw penetration.

Combined compression of the MSP gives increased dynamic capacity which reduces the risk of complications. The low rate of technical failure in our series compares favourably with that of the sliding hip screw or the Gamma nail but randomised trials comparing the MSP with other hip screw systems are necessary to find the true role of the MSP with its various sliding modes.

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The Medoff sliding plate (MSP) is a new screw-plate system in which sliding and compression are along the femoral shaft instead of along the neck of the femur. Medoff and Maes (1991) reported no technical failures with the MSP in 25 patients with unstable intertrochanteric or high subtrochanteric fractures.

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In a recent study of 104 intertrochanteric fractures in which we used the MSP according to Medoff's principle with one-way compression along the femoral shaft, there were seven technical failures, all lag-screw penetrations (Lunsjö et al 1995). In six of these seven cases the sliding capacity of the plate had been used to its outer limit; the sliding plate had become a rigid plate. Sliding of the lag screw had been impeded by the special locking-set screw in the MSP. Used in this way, the rate of technical failure of the MSP with one-way compression along the femoral shaft was much the same as the 2% to 20% reported in studies with the sliding hip screw (SHS) (Wolfgang, Bryant and O'Neill 1982; Rao et al 1983; Mainds and Newman 1989; Simpson, Varty and Dodd 1989; Bannister et al 1990; Larsson, Friberg and Hansson 1990; Leung et al 1992).

Our aim in this study was to determine if two-way compression along the shaft and neck of the femur, allowing combined free sliding of the plate and lag screw without the use of the locking-set screw, is a better method than Medoff's original principle and reduces the incidence of technical failure.

PATIENTS AND METHODS

The MSP, originally called the axial compression screw, is a modification of a sliding hip screw (SHS) with the side-plate replaced by two components which can slide up to 2.5 cm during fracture compression. The side-plate is curved in section and allows bone screws to be placed in two planes. The lag screw can be prevented from sliding laterally in the barrel of the plate by a locking-set screw. A distal compression screw allows intraoperative longitudinal compression along the femoral shaft (Fig. 1).

During 1993, we used the MSP in 108 consecutive patients with intertrochanteric fractures. Patients with pathological fractures or previous surgery of the proximal femur were excluded, as were those with undisplaced two-part fractures since they usually heal uneventfully regardless of the method of fixation (Jensen, Tøndevold and Sonne-Holm 1980). The mean age of the patients was 82 years (50 to 96) and the female:male ratio was 2.9:1. Seventy-one patients were admitted to the hospital from their own homes and 67 had been able to walk without any aids before the fractures. Ten patients had concomitant fractures which delayed their

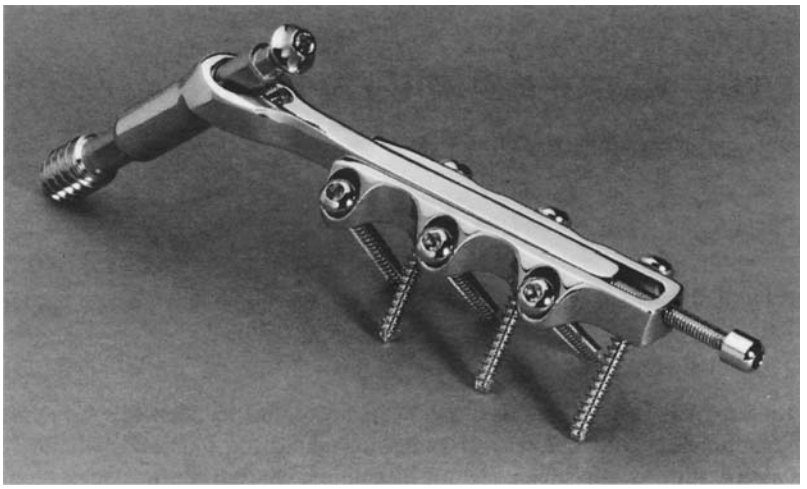

Fig. 1

The Medoff sliding plate in a combined sliding mode. The site for the locking set screw is seen at the lower border of the barrel. The bone screws are placed in two planes.

mobilisation. The operations were performed by 17 surgeons with varying degrees of orthopaedic experience. The locking-set screw was not used, thus allowing sliding of both the plate and the lag screw.

Radiographs were taken on admission, on days one and seven and at four and 12 months postoperatively. The fractures were classified according to the Jensen and Michaelsen modification of the Evans system (Jensen and Michaelsen 1975) (Fig. 2).

Operative technique. On admission a tibial pin is inserted for traction. The operative technique is similar to that for the SHS but there are some important details. Overdistraction of the fracture must be avoided during the operation. If not corrected, it may impair the dynamic capacity of the sliding plate and turn the device into a rigid system, which substantially increases the risk of lag-screw penetration when the locking-set screw is used.

If the fracture is proximal to the entry site for the lag screw on the lateral femoral cortex, compression along the femoral shaft is impeded. To prevent this, the entry hole should be enlarged up to 2.5 cm distally with a rongeur to allow compression. If, however, the fracture is distal to the entry site of the lag screw, there is unimpeded axial compression and no enlargement of the entry hole is needed. Prophylactic anticoagulant therapy with dextran 70 (500 ml, Macrodex; Medisan, Uppsala, Sweden) was given intravenously before operation and repeated during the operation. Low-molecular heparin (40 mg Klexane; Rhone Poulenc Rorer, Helsingborg, Sweden) was given subcutaneously daily until the patient was mobilised. Prophylactic antibiotics (cefuroxime 750 mg, Zinacef; Glaxo, Mölndal, Sweden) were administered intravenously during the operation and repeated twice at eight-hour intervals after operation.

We recorded any deviation from the routine operation, the peroperative blood loss as estimated by the anaesthetist nurse, the operating time 'skin to skin', the length of the skin incision, and the hospital stay.

Immediate full weight-bearing was allowed in 100 patients, but delayed in the remaining eight for six weeks

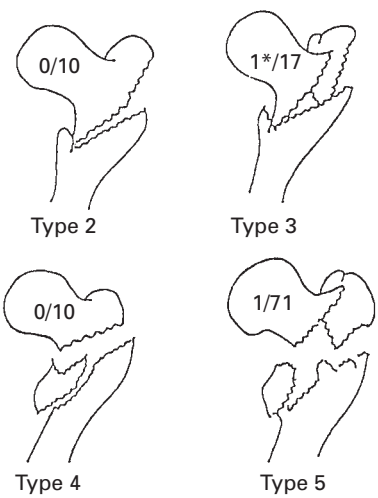

Fig. 2

The intertrochanteric fractures were classified according to Jensen and Michaelsen (1975). The number to the left of the line represents technical failures and that to the right the total number of fractures of each type (* = intraoperative technical failure).

because the fracture was thought to have an unusually unstable configuration.

Deep wound infection (defined as a positive culture from beneath the deep fascia), superficial wound infection (defined as a positive culture above the fascia), pulmonary embolism (diagnosed by scintigraphy) and deep-venous thrombosis (diagnosed by phlebography) were noted. Technical failures were defined as lag-screw penetration, breakage or loosening of the plate or nonunion of the fracture. Migration of the lag screw within the femoral head or varus angulation of the fracture without lag-screw penetration was not regarded as a technical failure. The amount of postoperative dynamic compression (Table I) was followed as well as the healing process.

Table I. Degree of postoperative sliding of the plates and of the lag screws in 83 patients at the four-month follow-up

	Lag screw		
Plate	**O***	**I***	**M***
M	1	11	4
I	21	36	-
O	5	5	-

* O = no sliding; M = maximal sliding; I = intermediate sliding, i.e., between the two extremes

At four and 12 months after operation the domestic situation and walking ability were recorded. Five patients were unable to attend for clinical and radiological follow-up at four months and another five at one year, but all ten patients were followed up by telephone.

Statistical analysis. The mean age of the patients, the female:male ratio, prefracture walking ability and the distribution of the fracture types were almost identical to those in our previous series of patients operated on with one-way compression along the femoral shaft (Lunsjö et al 1995). We used the chi-squared test with Yates' correction to determine any significant differences in technical failure rate between the two series.

RESULTS

In three patients we did not use the standard operative methods, but this did not cause technical failure. In two a supplementary cerclage wire was used and in the third an extra bone screw was inserted for stabilisation of the fracture.

The mean intraoperative blood loss was 386 ml (25 to 1600). The mean operating time was 67 minutes (35 to 180) and the mean length of skin incision was 19 cm (14 to 25). The mean hospital stay was 17 days (3 to 76). There were no deep wound infections or deep-venous thromboses, but 13 superficial wound infections and one pulmonary embolus were recorded.

Twenty patients died within four months of the operation and another 12 between four and 12 months. At one year, 22 of the 51 survivors who had walked without an aid before the fracture still did so. Forty-six of the 56 survivors who came from their own homes had returned home.

At one year all the fractures had healed. Postoperative dynamic compression along the shaft and the neck of the femur took place up to four months after the operation, most occurring during the first postoperative week (Figure 3). It was most pronounced along the femoral shaft. In most cases there was combined sliding (Table I). Maximal sliding of the plate occurred in 16 patients of whom 15 had lag-screw

Fig. 3a

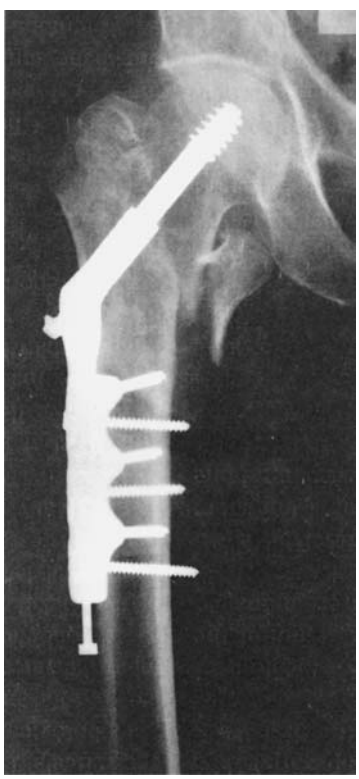

Fig. 3b

Fig. 3c

Radiographs at day 1 (a) day 7 (b) and at four months (c) postoperatively. Sliding began and was most pronounced along the femoral shaft during the first postoperative week. There was combined dynamic compression and the fracture found a stable position for healing.

sliding; all had type-3 or type-5 fractures (Figure 2). There was no maximal sliding along the shaft or the neck of the femur in type-2 and type-4 fractures.

The only postoperative technical failure was lag-screw penetration in one type-5 fracture (Figure 2) with maximum sliding of the plate and submaximal sliding of the lag screw. The patient was a 90-year-old woman with few radiological bone trabeculae in the head and the neck of the femur. The lag screw had been placed 2 cm from the joint space. Consequently, there was poor grip of the lag screw in the head of the femur with subsequent varus deformity of the fracture and lag-screw penetration. Paradoxically, this woman could walk with a frame with little pain and she was not interested in reoperation.

One intraoperative complication occurred in an 80-year old woman when the tip of the lag screw was placed 2 mm into the joint space. The patient died in cardiac failure 11 days after operation.

The postoperative technical failure rate was 1% which was significantly different from that of our previous series (7%; Lunsjö et al 1995).

DISCUSSION

The one-year mortality rate in our series was higher than that in the series of Høgh (1982), Larsson et al (1990) and Leung et al (1992), probably due to the fact that the mean age of our series was four to six years higher. Almost half of our patients who had been independent walkers before the fracture had regained the same walking ability after one year. In the series of Larsson et al (1990) and of Parker and Pryor (1993) two-thirds of the patients recovered their walking ability, but these included patients with undisplaced two-part intertrochanteric fractures. In our series the rate of return to home was similar to that of the series of Larsson et al (1990).

The mean operating time and mean intraoperative blood loss in our series were similar to those reported for the MSP used with one-way compression along the femoral shaft (Lunsjö et al 1995) and for the SHS (Sernbo et al 1988; Larsson et al 1990; Broström et al 1992; Leung et al 1992; Sernbo, Johnell and Gärdsell 1994). The mean scar length was 3 cm longer than that with the four-hole SHS (Leung et al 1992).

We believe that it is justified to compare our present results with those of our previous series (Lunsjö et al 1995). Both series were prospective, consecutive and also sequential; the clinical details and incidence of fracture types were almost identical. The rate of lag-screw penetration decreased significantly when two-way compression was allowed. This may be explained by the increased dynamic potential of combined sliding, which reduced the risk of lag-screw penetration in an osteoporotic unstable intertrochanteric fracture. Increased familiarity with the use of the MSP was probably also important.

Although two-way compression with the MSP in intertrochanteric fractures gives outcomes which compare favourably with the results of other hip screw systems and the Gamma nail (Jacobs et al 1976; Wolfgang et al 1982; Rao et al 1983; Cobelli and Sadler 1985; Mainds and Newman 1989; Simpson et al 1989; Bannister et al 1990; Larsson et al 1990; Calvert 1992; Leung et al 1992), randomised trials will be of benefit to assess the possible advantages of the MSP in different types of proximal femoral fracture.

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