

# Functional Outcome of the Minimally Invasive Plate Osteosynthesis for the Supracondylar Fractures of Femur Using Dynamic Condylar Screw

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## ABSTRACT

**Objective** To assess the functional outcomes of minimally invasive plate osteosynthesis (MIPO) for the extra-articular and undisplaced intra-articular supracondylar fractures of femur using dynamic condylar screw (DCS).

**Study design** Descriptive case series.

**Place & Duration of study** Department of Orthopaedic Surgery, Jinnah Postgraduate Medical Centre Karachi, from April 2009 to October 2011.

**Methodology** Patients were enrolled from accident and emergency and OPD. OPD follow-ups were carried out at 2<sup>nd</sup>, 6<sup>th</sup>, 12<sup>th</sup>, 18<sup>th</sup>, and 24<sup>th</sup> weeks, then every 2<sup>nd</sup> month for the assessment of rate of union and range of motion of knee joint.

**Results** A total of 83 patients were included. There were 55 males and 28 females. Male to female ratio was 1.96:1. Patients were 25-50 year of age. Seventy four (89.2%) of the injuries were caused by road traffic accident and 9 (10.8%) due to fall from height. Forty six (55.4%) patients had fractures on right side and 37 (44.6%) on left side.

Radiological union was achieved in 79 (95.2%) patients at an average period of 19.05 weeks. The radiological bony union was achieved in 16-18 weeks in 25(30.1%) patients. Four patients developed nonunion for which bone graft from iliac crest was placed after 24 weeks. Two achieved union in one year follow up while two were lost to follow up.

At end of one year, forty-three (51.8%) cases had knee flexion from zero to 90°- 120°, 25 (30.1%) cases had knee flexion of > 120° and remaining 15 (18.1%) cases had knee flexion of <90°. At the end of one year satisfactory (knee motion > 90°) functional outcome as achieved in 68 (81.9%) cases.

**Conclusion** High rates of both radiological union (95.2%) and satisfactory (knee motion > 90°) functional outcome (81.9%) were achieved in large number of cases.

**Key words** Femur-supracondylar fractures, Minimally invasive plate osteosynthesis, Dynamic condylar screw.

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## INTRODUCTION:

There has been a changing philosophy towards the surgical treatment of supracondylar fractures of the femur.<sup>1</sup> Changes have been made in the terms of implant design and technique of fixation of these fractures.<sup>2</sup> As a result of these changes, the dynamic condylar screw, distal femoral locking plates and

and retrograde interlocking nails are preferred over the angle blade plates, Fickle devices, Rush rods and Ender's nails to achieve better results.<sup>5</sup> Similarly changes have been made to minimize the soft tissue damage and preserve fracture hematoma by using the minimally invasive percutaneous plate osteosynthesis technique or less invasive stabilization system (LISS).<sup>1</sup>

Dynamic condylar screw has been found to be less technically demanding and provided good to excellent results as compared to other implants in treating patients with supracondylar and simple intracondylar fractures of the femur.<sup>3</sup> Traditionally the DCS has been used by the open technique by exposing the fracture site. Conventional open reduction and internal fixation may lead to the complications because of excessive soft tissue stripping, though early surgical stabilization can facilitate care of the soft tissues, permit early mobility and improves the nursing care.<sup>4,5</sup>

Minimally invasive surgical techniques with different implants rely on biological fixation, preservation of fracture hematoma and soft tissue cover instead of anatomical reduction and rigid fixation and involves inserting a plate percutaneously, bridging the fracture and achieving distal and proximal secured fixation.<sup>6</sup> The concept of absolute rigid plate fixation has been replaced with more elastic fixation allowing micro motion at fracture level encouraging bone healing with abundant callus.<sup>7</sup> This type of bone healing is much stronger than the direct healing process that follows the rigid fixation.<sup>8</sup>

Minimally invasive percutaneous plate osteosynthesis with DCS was developed for the treatment of the supracondylar fractures of the femur and it takes advantage of the two-part properties and two-plane alignment capabilities of the DCS, which is inserted through a small incision and then slid in submuscular plane to bypass the fracture site. The rate of primary bone union achieved has been reported to be 94% with the principle of minimally invasive percutaneous plating in distal femur fractures.<sup>4</sup> However the range of knee motion reported does not match with the union rate (excellent 50%, good 33.5% and poor 16.5%)<sup>3</sup>. This is a significant problem in our culture as full knee flexion is required for our religious activities and daily chores. These results can be improved with better fixation, decreasing the amount of soft tissue trauma and early range of motion exercise. Indirect reduction and MIPO with DCS can produce favorable results in supracondylar fractures of the femur.<sup>4,9</sup> This study was undertaken to find out the results of fixation of supracondylar fractures

of femur with dynamic condylar screw and plate with minimally invasive percutaneous osteosynthesis plate fixation.

#### **METHODOLOGY:**

This was a descriptive case series done at the Department of Orthopaedic Surgery, Jinnah Postgraduate Medical Centre Karachi, from April 2009 to October 2011. Convenience sampling technique was used to recruit the subjects. Patients with closed AO type A-1,2,3 and C-1 fractures (less than two weeks old) in a 20-60 year population, were included. However patients with preexisting stiff knee, stroke, dyskinesia, immunosuppression, restricted mobility due to other co morbidities, poor quality skin over knee, local infection or pathological fractures were excluded from the study. The dependent variables were fixation of these fractures with DCS using MIPO technique and the independent variable was fracture healing rate and functional outcome. The confounding variables were the severity of initial injury and the fracture geometry, stability of fixation, adherence to rehabilitation, presence of osteoarthritis of the knee, postoperative wound infection and degree of quadriceps fibrosis.

The fracture was considered united when there was no pain on movements at fracture site clinically and with presence of callus or disappearance of fracture line on x-ray. The active range of knee motion was measured with the help of goniometer and was determined according to the modified Schatzker scale. The range of movements were taken as flexion 0–135°. Results was satisfactory when flexion was excellent (>120°) or good (90 - 120°), unsatisfactory when flexion was poor (< 90°).

Patients meeting the inclusion criteria were admitted to the ward and limb was rested on Braun's fracture frame on skin or skeleton traction depending upon patients weight and expected delay in surgery. The data regarding age, sex, fracture type, coexisting health problems were recorded on a proforma. Written informed consent was taken from the subjects pre-operatively. Prophylactic I/V antibiotic the third generation cephalosporin, was given at the time of induction and was switched to oral after changing the dressing on the 2<sup>nd</sup> postoperative day. Oral antibiotics were continued for five days.

For the procedure patient was kept supine on simple radiolucent table with pillow under the buttock. Incision of 4cm placed for inserting DCS and 2nd incision made above the fracture line. Under image intensifier, a wire was drilled into condyles (10cm

above and 10cm posteriorly from articular cartilage) with the help of guide after identifying the knee joint line. In case of intercondylar fracture component, it was reduced by traction and indirect means and small arthrotomy, when required. It was temporarily stabilized with K wires and large malleolar or pelvic clamps. Reaming was done and appropriate size screw was inserted. Submuscular plane was developed and plate was slid without opening the fracture site and guided over the screw with the help of guide pin and slight manipulation. Small incision was made above the fracture site and plate was clamped after checking fracture reduction under image intensifier. Definite fixation with appropriate screws proximal and distal to fracture site was done. Wound was closed after placing the drain which was removed 24 to 48 hours later.

Postoperatively limb was again placed on Braun's frame. Patients were mobilized on the bed in the evening of operative day and allowed to sit in the bed on 1<sup>st</sup> postoperative day with gentle active and passive knee exercises depending upon the stability of the fixation. A rehabilitation program based upon the fracture stability, age and weight of patient including knee flexion, quadriceps exercise and non weight bearing ambulation, was explained and demonstrated with the help of a physiotherapist. Patients were discharged on 3<sup>rd</sup> postoperative day and followed in outpatient department at 2nd, 6th, 12th 18th and 24th week and then every 2nd month in case of uneventful recovery. This protocol was modified in case of complications and was individualized. Partial weight bearing was started after six weeks and full weight bearing after 3 months provided fracture united. Assessment of rate of the union and range of motion of the knee joint was done according to the modified Schatzker scale at regular intervals and final outcome was assessed at one year follow up.

### RESULTS:

There were eighty three patients in this study with mean age of 32.3 year (range 20-60 year). There were 55 males and 28 females. Fifty-three (63.8%) patients were between 25-50 year of age, 20 (24.1%) below 25 year and 10 (12.1%) above 50 year. Seventy four (89.2%) of the injuries were caused by road traffic accident and 9 (10.8%) due to fall from height. Forty six (55.4%) patients had fractures on right side and 37 (44.6%) on left side.

Radiological union was achieved in 79 (95.2%) patients at an average period of 19.05 weeks. The radiological bony union was achieved in 16-18 weeks in 25 (30.1%) patients, while in 54 (69.9%) cases

union was achieved in 18 to 24 weeks. Four patients developed nonunion for which bone graft from iliac crest was placed after 24 weeks. Two achieved union at one year follow up while two patients were lost to follow up after 9 month. Radiological union rate was high in the males (55 out of 55) as compared to 24 out of 28 in females.

At the end of one year, follow up forty-three (51.8%) cases had knee flexion from zero to 90°- 120°, 25 (30.1%) cases had knee flexion of > 120° and remaining 15 (18.1%) cases had knee flexion of <90 degree. At the end of one year, satisfactory (knee motion > 90°) functional outcome was achieved in 68 (81.9%) cases.

### DISCUSSION:

In this study the union rate was 95.2% which is comparable to Dar and Khan.<sup>3,10</sup> Another study from Peshawar reported 93.5% union rate.<sup>11</sup> A Turkish study also achieved 87.5% union rate which was similar to this study.<sup>12</sup> A study reported that the rate of primary bone union was 94% with principle of minimally invasive percutaneous plating in distal femur fractures.<sup>4</sup>

Much attention was given to the range of knee movements in the follow up period. Initially passive movements for 2 days and then active movements were advised and we obtained knee range of movement comparable to international studies.<sup>13,14</sup> In 15 (18.1%) patients the range of knee movements was less than 90°. These were the patients who did not attend the physiotherapy department and were lost to follow up. 51.8% of cases had knee movement between 90°-120° while 25 (30.1%) cases had knee movement > 120°.

At the end of 24 weeks of follow up, satisfactory functional outcome was achieved in 81.9% cases. Male had more satisfactory results because of frequent follow ups and proper rehabilitation and physiotherapy. Christodoulou et al assessed DCS in a series of 80 elderly patients (average age 73.2 year) with supracondylar femoral fracture and reported good to excellent results in 81%.<sup>15</sup>

Successful management of distal femoral fractures is possible with adherence to basic principles of fracture fixation. Implant selection is determined on the basis of characteristics of the fracture, bone quality and experience of the surgeon. Although internal fixation by open reduction of the fracture may result in anatomical reduction, it also carries extensive soft tissue dissection, risk of infection and nonunion. Biological osteosynthesis maintains the arterial vascularity by preserving the soft tissue

envelope, minimizes surgical trauma to the zone of injury and results in high union and low complication rates. Biological osteosynthesis using DCS is a very good alternative for the treatment of distal femoral fractures

**CONCLUSIONS:**

In this study high rates of both radiological union and satisfactory functional outcome were achieved. Minimally invasive percutaneous plate osteosynthesis with dynamic condylar screw is one of the best devices to treat supracondylar fractures of the femur.

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