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Original article

Blade-plate fixation for distal femoral fractures: A case-control study

E. Vandenbussche[a,*], M. LeBaron[b], M. Ehlinger[c], X. Flecher[b], G. Pietu[d], SOFCOT[e]

[a] Service de chirurgie orthopédique et traumatologique, université René-Descartes, hôpital européen Georges-Pompidou, 20, rue Leblanc, 75015 Paris, France
[b] Service de chirurgie orthopédique, hôpital Nord, Assistance Publique des Hôpitaux de Marseille, chemin des Bourrely, 13015 Marseille, France
[c] Service de chirurgie orthopédique et traumatologie, université de Strasbourg, hôpital Hautepierre, Strasbourg University Hospitals, 1, avenue Molière, 67098 Strasbourg cedex, France
[d] Service de chirurgie orthopédique et traumatologique, CHU de Nantes, 1, place Alexis-Ricordeau, 44000 Nantes, France
[e] Société française de chirurgie orthopédique et traumatologique, 56, rue Boissonnade, 75014 Paris, France

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ABSTRACT

Background: The blade-plate is the earliest of the contemporary internal fixation devices introduced for distal femoral fractures. The recent development of dedicated, fixation devices has considerably limited its use. The objective of this study was to evaluate outcomes after blade-plate fixation and after fixation using other devices.
Hypothesis: Outcomes after blade-plate fixation are similar to those after condylar screw-plate, distal femoral nail, or locking condylar plate fixation.
Material and methods: We reviewed outcomes after 62 patients managed with blade-plate fixation and included in a multicentre retrospective study ($n=57$) or a multicentre prospective study ($n=5$) and we compared them to outcomes after fixation using condylar screw-plates ($n=82$), distal femoral nail ($n=219$), or locking condylar plates ($n=301$). The four groups were comparable for age, gender distribution, occupational status, prevalence of skin wounds, patient-related factors, type of accident, and type of fracture. The evaluation relied on the clinical International Knee Society (IKS) score and on radiographs.
Results: No significant differences existed across the four groups for operative time, blood transfusion use, complications, need for bone grafting, non-union rate, or IKS score values. The early surgical revision rate for removal of the fixation material was 4% with the blade-plate and 16% with the other three fixation devices ($P=0.02$). Post-operative fracture deformity was similar in the four groups with, however, a higher proportion of residual malalignment in the screw-fixation group. The final anatomic axis was $3.3\pm1.4^\circ$ with the blade-plate versus $2.3\pm3.7^\circ$ with the other three fixation devices. The blade-plate group had few patients with axial malalignment, and the degree of malalignment was limited to 3° of varus and 10° of valgus at the most, compared to 10° and 18° respectively, with the other three fixation devices.
Conclusion: Despite the now extremely limited use and teaching of blade-plate fixation, as well as the undeniable technical challenges raised by the implantation of this device, the blade-plate is a simple, strong, and inexpensive fixation method. It remains reliable for the fixation of distal femoral fractures. The disfavour into which the blade-plate is currently falling is not warranted.
Level of evidence: III, case-control study.

1. Introduction

The use of internal fixation to treat distal femoral fractures became standard practice only in the 1970s, when the surgical indications were broadened to displaced intra-articular fractures, a change that improved the functional outcomes. The optimal means of stabilising a distal femoral fracture was rapidly recognised as involving support from a diaphyseal plate combined with maximal-strength anchoring into the metaphysis and epiphysis. Thus, the 95° angled Müller blade-plate with no guidewire, initially designed for proximal femoral fractures, and the Judet screw-plate became the two preferred fixation options among

* Corresponding author.
E-mail address: eric.vdb@egp.aphp.fr (E. Vandenbussche).

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European surgeons. The Strelitzia blade-plate, known as the Maconor device, was introduced in 1975; angles of 90°, 100°, and 110° were available in the Maconor 1 version and, in 1987, a 95° fixed-angle option known as Maconor 2 was added to ensure guide wire positioning parallel to the joint space.

To date, no formal consensus exists about which fixation device is optimal for distal femoral fractures. Nevertheless, the growing popularity of contemporary condylar screw-plates, locking condylar plates and, finally, dedicated retrograde distal femoral nails recently prompted the major companies to stop producing Strelitzia blade-plates. At present, a single company, based in France, continues to produce and distribute the blade-plate to surgeons, particularly those in teaching hospitals, who want continued access to this simple, inexpensive and effective fixation device.

The objective of this study was to determine whether the use of this early fixation device remained reasonable. We compared clinical and radiological outcomes after blade-plate fixation to those after fixation using the three most widely used devices. Our hypothesis was that blade-plate fixation provided similar outcomes to those seen with condylar screw-plates, distal femoral nails, or locking condylar plate.

2. Patients and method

During the 2013 meeting of the French Society of Orthopaedic and Trauma Surgery (SOFCOT), the results of two multicentre studies were reported. One was retrospective and the other prospective, and the patients were recruited at 12 surgical centres.

Inclusion criteria were a distal femoral fracture included in the AO epiphyseal square or a diaphyseal-metaphyseal-epiphyseal distal femoral fracture, namely, a supracondylar fracture, supracondylar/intercondylar fracture, or uni-condylar fracture. Both studies excluded pathological fractures, peri-prosthetic fractures of the knee, fractures in children younger than 15 years and 3 months of age, and epiphyseal slippage fractures in individuals older than 15 years of age. The retrospective study included patients managed between January 2001 and December 2010 and the prospective study patients managed between June 1, 2011, and May 31, 2012 who had a follow-up of at least 1 year. For each patient, an online folder containing information sheets and standard pre-operative and post-operative imaging studies was created. The data in the folders allowed the analysis and validation of the fracture type in the universal Orthopaedic Trauma Association (OTA) classification available online on the OTA site [1]. Clinical outcomes were evaluated using the International Knee Society (IKS) knee and function scores [2].

Of the 899 included patients (716 in the retrospective study and 183 in the prospective study), among patients managed with internal fixation 62 were managed with blade-plates (5 in the prospective study and 57 in the retrospective study), 82 with Chiron- or DCS-type plates or condylar screw-plates, 219 with distal femoral nails, and 301 with locking condylar

Table 1
Models used for the four types of internal fixation.

Blade-plate ($n=62$)	Plate or screw-plate ($n=82$)	Nail ($n=219$)	Locking plate ($n=301$)
LP Strelitzia (Medicalex), $n=40$ LP AO (Zimmer), $n=22$	Chiron screw-plate (Howmedica), $n=55$ DCS screw-plate (Zimmer), $n=23$ Standard plates, $n=4$	T2 Supracondylar Nail (Stryker), $n=128$ Trigen (Smith and Nephew), $n=46$ Other nails, $n=45$	LCP (Synthes), $n=230$ AxSOS and Numelock (Stryker), $n=4$ PDF Locking Plate (Zimmer), $n=15$ Other locking plates, $n=15$

Table 2
Pre-operative data.

Type of internal fixation	Blade-plate ($n=62$)	Plate or screw-plate ($n=82$)	Nail ($n=219$)	Locking plate ($n=301$)
Age (years)				
m	63.1	57.8	64.6	60.7
SD	25.5	23.7	23.1	24.1
Min	15	16	16	15
Max	102	95	101	105
Sex				
F (%)	63	46	64.4	55.1
M (%)	37	54	35.6	44.9
BMI				
m	21.9	22.2	22.1	24.2
SD	8.8	9.2	8.1	7
Status				
Retired (%)	63	47	62	53
Employed (%)	37	53	38	47
Type of accident (%)				
Fall from standing height 61	48	62	55	
Fall from elevated height	10	14	9	6
2-wheel vehicle accident	10	23	4	17
Car accident	14	11	12	14
Motor vehicle-pedestrian accident	5	0	0	3
Sport injury	0	1	0	3
Other	0	3	3	2
AO fracture type (%)				
A	48	33	55	45
B	0	4	2	7
C	52	63	43	48
Compound fracture (%)	23	22	19	15

n: number of patients; m: mean; SD: standard deviation; min: minimum value; max: maximum value.