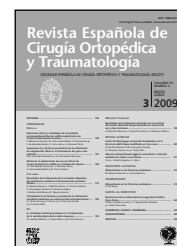




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### ORIGINAL PAPERS

## Treatment of iliosacral joint fracture dislocations by means of an anterior extraperitoneal approach

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### KEYWORDS

Iliosacral joint;  
Bone fracture;  
Internal fixation of  
fractures;  
Bone plates

### Abstract

**Purpose:** To assess the outcome of addressing iliac wing fractures with involvement of the iliosacral joint by means of open reduction and internal fixation (ORIF) with plates, using an anterior extraperitoneal approach

**Materials and methods:** We reviewed pelvic fractures treated in our hospital, collecting epidemiological data of those with a posterior injury pattern that corresponded to a fracture affecting the iliosacral joint. For all 14 cases included in the study, we carried out a functional assessment according to the Majeed scale, as well as a radiological evaluation according to the Matta classification.

**Results:** The functional assessment revealed that an excellent result was achieved in 8 cases and a good result in 5. A poor outcome was obtained in one single case. According to the postoperative radiological evaluation, reduction was excellent in 10 cases and good in the remaining 4. There was no loss of reduction or any major complications.

**Conclusion:** The technique described in our paper affords sufficient stability for fracture healing and it is associated with a low incidence of complications. It is especially indicated for multiple-trauma patients where the only position recommended in the supine one, for cases where the posterior soft tissues are involved, and when an open reduction of the fracture is needed.

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**PALABRAS CLAVE**

Articulación  
sacroilíaca;  
Fractura ósea;  
Fijación interna de las  
fracturas;  
Placas óseas

## Tratamiento de la fractura y luxación de la articulación sacroilíaca mediante un acceso anterior extraperitoneal

**Resumen**

**Objetivo:** Valorar los resultados del tratamiento de las fracturas del ala ilíaca con afectación de la articulación sacroilíaca mediante una reducción abierta y una fijación interna con placas a través de abordaje anterior extraperitoneal de la articulación sacroilíaca.

**Material y método:** Se han revisado las fracturas de pelvis tratadas en el hospital y se han recogido los datos epidemiológicos de aquéllas en las que el patrón de lesión posterior correspondía a una fractura que alcanzaba la articulación sacroilíaca. En los 14 casos incluidos en el estudio se realizó la valoración funcional según la escala de Majeeed y la valoración radiológica según la clasificación propuesta por Matta.

**Resultados:** Al realizar la valoración funcional, en 8 casos se consiguió un resultado excelente, en 5 casos se consiguió un resultado bueno y sólo en un caso el resultado fue malo. De acuerdo con la valoración radiológica postoperatoria, la reducción fue excelente en 10 casos y fue buena en los 4 casos restantes. No se produjo ninguna pérdida de reducción ni complicaciones mayores.

**Conclusiones:** La técnica descrita confiere suficiente estabilidad para la consolidación de las fracturas y su incidencia de complicaciones es pequeña. Se indica especialmente en los sujetos politraumatizados a los que se desaconsejan posiciones distintas al decúbito supino, cuando hay compromiso de partes blandas posteriores y en aquellos casos en que se precisa realizar una reducción abierta de la fractura.

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## Introduction

The iliosacral joint is considered a weight-bearing joint<sup>1</sup> that can potentially be affected by posttraumatic arthritis, chronic instability or mal-position union (with the consequent pain) if not treated appropriately. Holdsworth and Tile have described a high rate of incidence of lumbar pain and incapacity to perform light work in untreated subjects, in comparison with those that underwent surgery.

To avoid painful sequelae it is indispensable to re-establish joint congruence and stability, therefore open reduction and internal fixation of iliosacral joint lesions are necessary, except in those cases in which an acceptable joint congruence may be achieved using closed methods.

There is certain controversy related to the fixation technique appropriate for these lesions.

Posterior extra-pelvic access<sup>1-4</sup> is easy, safe and allows the application of inter-fragment compression using 1 or 2 screws placed between both iliac tables, as well as 1 or 2 neutralization plates on the external cortical bone, without any need for trans-articular fixation. Amongst its disadvantages are the greater risk of infection, skin necrosis and problems related to wound healing<sup>5</sup>. Another drawback related to this route is the fact that the iliosacral joint is not completely visible, which means, therefore, that reduction must be confirmed by palpation of the anterior surface of the joint by introducing a finger through the greater sciatic notch<sup>5</sup>.

Another therapeutic option is open reduction and internal fixation using an anterior approach. This approach makes it possible to avoid damaging soft tissues which are already affected by the trauma itself and to perform reduction in plain view, at the cost of setting at risk the nerve roots of the fifth lumbar vertebra (L5) and the fourth lumbar vertebra (L4).

The aim of this article is: to prove that plate fixation of the iliosacral joint using an anterior approach confers sufficient stability to achieve union of iliosacral joint lesions; to assess the complications of this technique, and to evaluate its functional results and residual iliosacral pain.

## Materials and methods

A case study was performed in which all pelvis fractures treated in our Hospital between 1994 and 2006 were retrospectively reviewed. Clinical data was collected from those cases with a posterior lesion pattern corresponding to a fracture that involved the iliosacral joint.

Twenty-one subjects were found with this lesion. Four were not treated at our Hospital: Three because they were sent to their referring hospital (and therefore fixation was not performed in this Hospital) and one patient died 3 weeks after the accident due to associated lesions. In 2 subjects the posterior lesion was treated orthopedically and in a third subject fixation was performed with an

iliosacral screw, since the posterior fragment was very small.

The 14 remaining subjects were included in the study, and classified according to Tile<sup>6</sup> modified criteria. To better define the posterior lesion pattern, AP, 45° oblique descending and ascending (*inlet and outlet*) pelvis X-rays were performed in all subjects, as also CTs. Eight cases were classified as B2.1 (ipsilateral) lesions, 3 cases as B2.2 (contralateral [bucket-handle]) lesions, one case as C1.1

(ilium fracture) lesion and 2 cases as C1.2 (iliosacral disjunction) lesions.

Of the 14 subjects, 9 were men and 5 were women. Average age was 36 years (range 15-65) at the time of accident. The most frequent cause of the lesion was traffic-accidents in 78.5% of cases, fall from a height in 14.3% of cases and run-into by a motor vehicle in 7.2% of cases. It is possible to see the clinical data of the 14 patients included in this study in table 1.

**Table 1** Subject data, type of lesion, treatment carried out, functional and radiological results and complications

Case	Age	Sex	Tile	Cause	Posterior Os.	Anterior lesion	Anterior Os.	Follow-up (months)	Majeed Scale	CVD (mm)	Complications
1	65	Man	C1.2	Run-into	4 plates	Bilateral rami fracture	IL Plate	124	100	0	
2	37	Man	B2.2	Traffic accident	1 plate	Rami fracture	2 PP plates	117	90	0	
3	52	Woman	B2.1	Traffic accident	2 plates	Bilateral rami fracture	IL Plate	102	100	0	Thigh hypoesthesia
4	45	Man	B2.1	Fall from a height	2 plates	Bilateral rami fracture	2 PP plates	96	92	8	Erectile dysfunction and external popliteal sciatic nerve lesion
5	18	Woman	B2.1	Traffic accident	1 plate	Rami fracture	2 IL plates	84	80	0	
6	24	Man	B2.2	Traffic accident	2 plates	Rami fracture	PF Plate	80	86	5	
7	27	Man	C1.1	Traffic accident	4 plates	Rami fracture	IL Plate	71	80	2	
8	15	Woman	B2.2	Traffic accident	2 plates	Rami fracture	IL Plate	61	100	3	Intraoperative hemorrhage Breakage of the plate at the symphysis Leg length discrepancy due to femur non-union
9	41	Man	B2.1	Traffic accident	2 plates	Rami fracture	IL Plate	40	41	6	
10	33	Woman	B2.1	Traffic accident	2 plates	Rami fracture	IL Plate	38	81	0	
11	63	Man	C1.2	Traffic accident	3 plates	Rami and pubic dyasthesis fracture	2 PP plates	31	100	0	Intraoperative posterior hemorrhage
12	26	Woman	B2.1	Traffic accident	2 plates	Rami fracture	IL Plate	24	96	0	Lateral thigh dysesthesia
13	25	Man	B2.1	Traffic accident	2 plates	Rami fracture	IL Plate	24	82	0	
14	38	Man	B2.1	Fall from a height	2 plates	Contralateral rami fracture	Contralateral IL plate	24	80	7	

B2.1: Ipsilateral; B2.2: contralateral (bucket-handle); C1.1: Ilium fracture; C1.2: Iliosacral disjunction; PSEN: External Popliteal sciatic nerve; CVD: Combined vertical displacement; IL: Iliioinguinal; Os: Osteosynthesis, PF: Pfannenstiel.

Once the subject was hemodinamically stabilized and the imaging studies were complete, fracture reduction and fixation was performed. It is thought that reduction and fixation of anterior lesions makes it easier to reduce posterior lesions, therefore anterior osteosynthesis was performed first, with 3.5 mm reconstruction plates and subsequently (also in a supine position) the posterior lesions were fixated using an anterior approach the iliosacral joint<sup>7</sup>. If the anterior lesion is an ipsilateral rami fracture, a complete ilioinguinal approach is used to fixate both lesions. After open view fracture reduction, the location of the fracture lines was evaluated and 1 or several 3.5 mm (Synthes) reconstruction plates were placed.

We chose 3.5 mm reconstruction plates for fracture fixation: In 2 cases one plate was used, in 9 cases 2 plates, in one case 3 plates and in 2 cases 4 plates were necessary. In 9 cases the anterior and posterior lesions were fixated by means of an ilioinguinal approach, whereas in case 14 the anterior lesion was fixated using an ilioinguinal approach and the posterior lesion was fixated using an iliosacral joint anterior approach using the contralateral side. A Pfannenstiel approach was used in the 4 remaining subjects to fixate the anterior lesion. In Table 1 it is possible to see the anterior lesion pattern, surgical access and the type of osteosynthesis used in each case.

During closure the iliac muscle was reinserted on the internal border of the iliac crest by means of transosseous stitches, followed by re-anchorage of the muscles of the abdominal wall to the external lip of the iliac crest and the gluteal muscles, all over an aspiration drainage to prevent hematoma formation.

After surgery 3 control X-rays were taken and antibiotic prophylaxis was administered using first generation cephalosporin during 24 hours. Low molecular weight heparin was administered during 1 month as thromboembolic prophylaxis. Subjects sat up on the second day and immediately began physiotherapy. In the case of ipsilateral lesions the patients were allowed non-weightbearing movements, whereas complete non-weightbearing was necessary if both hemipelvises were affected. As from the eighth week subjects began weightbearing.

Clinical and functional results were assessed by means of the Majed<sup>8</sup> scale that includes evaluation of the persistence of residual pain in the damaged iliosacral joint. Data on complications during and after surgery was also collected.

X-ray assessment was performed according to Matta<sup>9</sup> criteria, which distinguishes 4 groups according to residual displacement. Posterior lesion postoperative and final residual displacement were measured using 3 X-ray projections to assess the loss of reduction of the fixation achieved. By addition of these displacements in ascending and descending oblique projections it is possible to calculate combined vertical displacement<sup>9</sup>.

## Results

All subjects had a minimum follow-up of 24 months; mean follow-up was 66.5 months (range 24-124 months).

Assessing functional results it was seen that in 8 cases an excellent result was achieved, in 5 cases a good result and

a bad result was seen in only 1 case (case 9). This last case had no pain in the damaged iliosacral joint, but he did have a leg length discrepancy of 5 cm secondary to femur fracture that made walking and return to work difficult. Of the remaining 13 subjects, 8 had no iliosacral pain, or this was slight and occasional, 3 had supportable intermittent pain with normal activity and 2 had pain on moderate exercise but none at rest.

According to Matta's classification for postoperative X-ray assessment, excellent reduction was achieved in 10 cases (displacement less than 0.5 cm in any of the 3 X-ray projections) and in 4 cases a good reduction was achieved. Combined vertical displacement was less than 5 mm in 10 cases and in the other 4 cases it was variable: from 5 to 10 mm. In none of the 14 cases was there loss of fixation with secondary displacement during follow-up.

There were complications during surgery in 2 cases due to excessive hemorrhage, in one subject (case 11) when performing posterior fixation (it was controlled by packing and deferred closure) and in the other subject (case 8) there was hemorrhage after a lesion of a vascular plexus over the iliopubic ramus, which stopped on ligation.

There were no major postoperative complications related to the anterior approach to the iliosacral joint. Two cases of minor complications were seen with transient sensitive nerve alterations in the territory of the lateral femoral cutaneous nerve.

In table 1 it is possible to see the follow-up time, the complications and the clinical and radiological status of the subjects.

## Discussion

In patients with these lesions, supporters of the posterior route approach<sup>2,4</sup> are not in favor of the anterior approach because of the complications that may arise.

In the series here presented there were 3 cases with complications secondary to the approach used; in 2 subjects with transient lateral femoral cutaneous nerve lesions it must be remembered that a complete ilioinguinal approach was used, and therefore, the risk was greater than when the posterior iliac window was used and dissection may be prolonged excessively towards the anterior iliac window. This is the most frequent complication mentioned in the medical literature<sup>10,11</sup>. If this approach is used, special care must be taken not to damage the nerve roots of L5 or L4 which are on the sacral wing about 2 and 1.5 cm medially from the iliosacral joint line, respectively<sup>12</sup>.

Another disadvantage of this approach is that there can be excessive hemorrhage, or because the upper gluteal artery is damaged<sup>3</sup> or through decompression of the retroperitoneal hematoma. In the case in which there was hemorrhage this was controlled by packing and muscle and skin closure, the final closure was left for a second procedure.

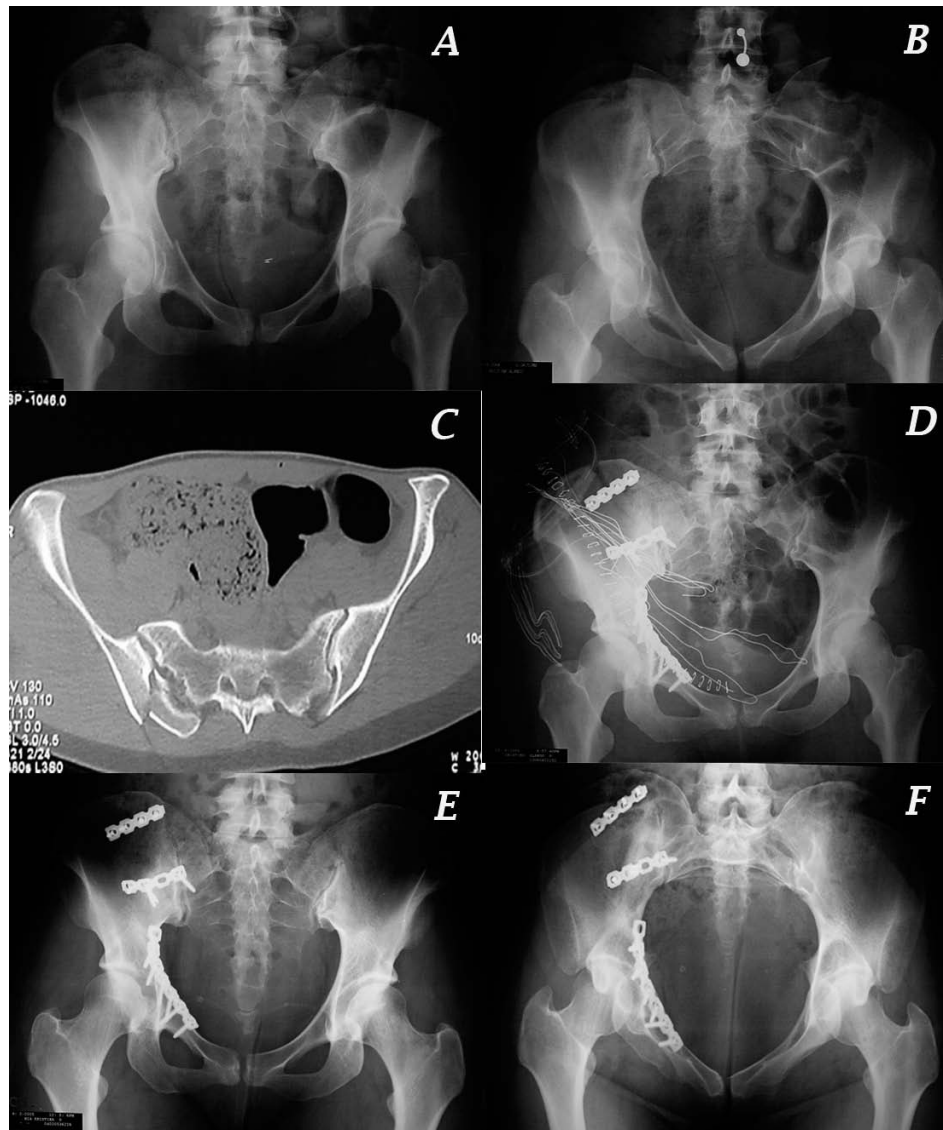
One of the main advantages of this approach is the lower infection rate<sup>5,10,11</sup> (in comparison with the posterior approach), in which it may reach 25%. The explanation is that in the posterior approach the incision is made through soft tissues that are frequently damaged due to trauma.

Another advantage of the anterior approach is that it is performed in the supine position<sup>5</sup> (posterior approach must be performed with the patient in a prone position or on their side). Subjects with pelvis fracture are usually suffering from poly-trauma and it is not rare for them to have associated lesions that prevent excessive mobilization or are even the cause of a prone position or lateral one being contra-indicated. The supine position, furthermore, makes it possible to treat other accompanying fractures.

There are different fixation methods for these lesions. Iliac<sup>13</sup> or iliosacral<sup>14,15</sup> screws can be inserted percutaneously with position control using image intensifiers (once the iliosacral lesion is reduced) or can be placed using open view procedures. The larger the posterior fragment, the

more difficult it is to control by means of iliosacral screws (Bareil<sup>16</sup> y Butt<sup>14</sup>).

Anterior plates have been proved to have, in biomechanical studies, the same stability as 3 iliosacral screws<sup>17</sup>, which is sufficient to achieve lesion healing, as indicated by the series we present here, in which there were no cases of secondary displacement nor intraoperative loss of reduction. Furthermore, this reduction was good to excellent in all cases, due to the fact that it was an open reduction with an open view. The reduction achieved in the series here described was excellent in 10 cases and left a residual defect of 5 to 10 mm in the remaining cases. These results agree with those seen in the medical literature. Leighton<sup>10</sup> achieved union with no loss of fixation in 42 subjects using



**Figure 1** Case 12. A and B) AP and inlet X-rays of a woman with a right pelvis fracture due to lateral compression. It is possible to see the right ramus fracture and the displacement with internal rotation of the right hemipelvis. C) CT in which a crescent type fracture is seen, with slight posterior displacement of the anterior fragment of the iliac wing. The posterior fragment, smaller in size, is in the correct position, and is held there by the posterior ligament complex. D) Postoperative X-ray control after ilioinguinal approach surgery to place an anterior plate attached to the ramus fracture and 2 posterior plates. E and F) AP and inlet X-ray a year after pelvis fracture. Union has been achieved in a crescent type fracture with excellent reduction and no loss of reduction.

a special plate with 4 holes; Ragnarsson<sup>11</sup> also achieved fixation in the 23 subjects of his series suffering from iliosacral dislocation after performing fixation with a square plate with 4 holes placed using an anterior approach, with no loss of reduction (in one case one of the screws broke but this had no clinical repercussion). Kabak<sup>18</sup> treated 20 subjects with displaced fractures of the iliosacral joint and pure dislocations using fixation with 3.5 mm plates. He obtained a good reduction and residual inferior displacements of less than 1 cm in all subjects; there were no cases of material breakage, although there was screw loosening in 2 subjects (without loss of reduction).

Smpson<sup>5</sup> has described the results seen with different types of osteosynthesis material: of 8 subjects treated with iliosacral dislocation with staples, 2 suffered loss of reduction; of 8 subjects treated with 4.5 mm reconstruction plates or with a square plate with 4 holes; all achieved union and only one case suffered loss of reduction.

The number and placement of the plates varies according to the pattern of the lesion. For treatment of crescent type lesions (described by Borrelli<sup>2</sup> as lesions caused by lateral compression that are vertically stable) there are pre-designed plates<sup>5,10,11</sup>. In this study we preferred to use two 3.5 mm Synthes reconstruction plates. In the case of the upper plate, fixation was performed from ilium to ilium, whereas in the case of the lower plate, fixation was transarticular, from the sacral wing to the ilium (fig. 1). Placement of only one plate makes it possible to carry out

a compression of up to 10 mm<sup>10</sup>, but there is less rotation control, which makes it preferable to use 2 plates<sup>5</sup>.

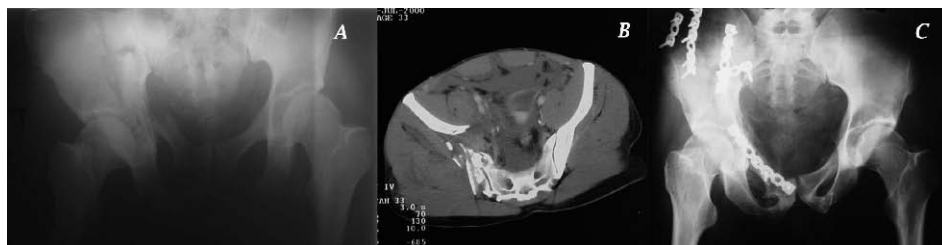
In cases in which as well as horizontal instability there is vertical instability, both the anterior and the posterior lesion require fixation to prevent secondary displacements. The posterior lesion may be fixated using 2 or more plates in the same way as in the case of crescent type fractures (fig. 2).

There is another lesion pattern in which iliac wing fracture lines reach the iliosacral joint. This type of lesion must be treated in the same way as extra-articular joint fractures of the iliac wing are treated<sup>3,19,20</sup>, i.e. reduction is performed through an anterior approach and fixation is by means of one or several plates placed on the internal surface of the iliac wing. The anterior approach is preferable since, as the fracture line has a more ventral location, a posterior approach makes it necessary to perform a larger release of the greater gluteal muscle and even of the middle gluteal muscle, which causes excessive traction of the upper gluteal nerves and vessels<sup>3</sup>. The placement and the number of plates must be determined by the fracture lines on the iliac wing<sup>20</sup> (fig. 3).

When analyzing results most articles classify them by stability criteria and not according to the pattern of the lesion. According to Dujardin<sup>21</sup>, the results obtained in cases with iliac wing fractures and iliosacral fractures and dislocations are better than those obtained in cases of pure dislocation or sacral fracture and he concludes that they



**Figure 2** Case 11. A) AP X-ray of a pelvis fracture showing the pubic symphysis lesion and the right ramus fracture with an increase of the joint space in the right iliosacral joint. B) CT image with a clearer posterior lesion in the case of fracture and dislocation of the right iliosacral joint, with significant displacement of the anterior fragment of the ilium, which caused it to be considered vertically unstable and to be classified as C1.2 (iliosacral disjunction) according to Tile's classification. C) X-ray control 1 year after fixation of an anterior lesion using 2 plates and a Pfannenstiel approach. The posterior lesion was fixated with 3 plates using an extraperitoneal anterior approach to the iliosacral joint.



**Figure 3** Case 7. A) AP X-ray of a subject with type C1.1 (iliac fracture) type pelvis fracture through the right iliac wing. B) CT image in which it is possible to see a comminuted iliac fracture in which several fracture lines reach the iliosacral joint. C) X-ray control at 16 months. An ilioinguinal approach was used to carry out fracture fixation. The fracture lines determine the number of plates and their placement on the iliac bone. In this case 4 plates were necessary, one of these was transarticular, for fixation of the iliac bone to the sacral wing.

evolve differently. For this reason, only iliac wing fractures with iliosacral joint involvement have been included in this study. Furthermore, the treatment employed may also be different.

When assessing functional results, there are authors who use very general scales, such as SF-36 (36-items Short-Form self-questionnaire), in which results may be affected by lesions in other parts of the body (frequent in subjects with fracture of the pelvis), which means that there is not a specific assessment of the outcome of pelvis fracture treatment. Other studies<sup>11,19</sup> use their own assessment scales which make it difficult to compare results. We have applied Majeed's<sup>8</sup> scale in this series, it assesses walking, return to work, sitting, sexual activity and pain. Furthermore it specially takes into account residual iliosacral pain. Although the sample in this study was small, good to excellent results were obtained in 92% of the cases, a number which supports the relative benignity of this lesion pattern. With the type of fixation used, only 2 subjects presented iliosacral pain with moderate exercise; in the rest of the subjects, there was no residual pain, or it was supportable when carrying out normal activity. Ragnarsson<sup>11</sup> obtained 85% of good to excellent results in his series of 23 subjects with iliosacral dislocation; 2 of these had pain that required daily painkillers and 6 presented slight to moderate pain. Kabak<sup>18</sup> described 9 poor results in his combined series of 20 cases of displaced fractures with iliosacral involvement and pure dislocations.

We believe that the treatment used on the series we have described achieves sufficient stability to bring about fracture union and has only a small percentage of complications. This procedure is especially indicated in subjects suffering from poly-trauma that can only be operated in a supine position, in cases with damage to posterior soft tissues and in subjects that require open fracture reduction.

## Conflict of interests

The authors have not received any financial support in the preparation of this article. Nor have they signed any agreement entitling them to receive benefits or fees from any commercial entity. Furthermore, no commercial entity has paid or will pay any sum to any foundation, educational institution or other non-profit-making organization to which they may be affiliated.

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